Access DB# 78610

SEARCH REQUEST FORM

Scientific and Technical Information Center

Requester's Full Name: Wilbert Offman Examiner # : 76211 Date: 10/24/02
Art Unit: 1742 Phone Number 308-2594 Serial Number: 09/522 815
Mail Box and Bldg/Room Location: CP3 7C07 Results Format Preferred (circle): PAPER DISK E-MAIL

If more than one search is submitted, please prioritize searches in order of need.

****

Please provide a detailed statement of the search topic, and describe as specifically as possible the subject matter to be searched. Include the elected species or structures, keywords, synonyms, acronyms, and registry numbers, and combine with the concept or utility of the invention. Define any terms that may have a special meaning. Give examples or relevant citations, authors, etc, if known. Please attach a copy of the cover sheet, pertinent claims, and abstract.

Title of Invention: ______________________________

Inventors (please provide full names): ______________________________

____

Earliest Priority Filing Date: 11/25/98

**For Sequence Searches Only* Please include all pertinent information (parent, child, divisional, or issued patent numbers) along with the appropriate serial number.*

****

STAFF USE ONLY		Type of Search		Vendors and cost where applicable	
Searcher:	ES	NA Sequence (#)		STN	P 145.91
Searcher Phone #:		AA Sequence (#)		Dialog	
Searcher Location:		Structure (#)		Questel/Orbit	
Date Searcher Picked Up:		Bibliographic	✓	Dr.Link	
Date Completed:	10-29-02	Litigation		Lexis/Nexis	
Searcher Prep & Review Time:	5	Fulltext		Sequence Systems	
Clerical Prep Time:		Patent Family		WWW/Internet	
Online Time:	70	Other		Other (specify)	

PTO-1590 (8-01)

```
=> file reg
FILE 'REGISTRY' ENTERED AT 17:02:59 ON 29 OCT 2002
USE IS SUBJECT TO THE TERMS OF YOUR STN CUSTOMER AGREEMENT.
PLEASE SEE "HELP USAGETERMS" FOR DETAILS.
COPYRIGHT (C) 2002 American Chemical Society (ACS)

Property values tagged with IC are from the ZIC/VINITI data file
provided by InfoChem.

STRUCTURE FILE UPDATES:    28 OCT 2002  HIGHEST RN 467213-35-0
DICTIONARY FILE UPDATES:   28 OCT 2002  HIGHEST RN 467213-35-0

TSCA INFORMATION NOW CURRENT THROUGH MAY 20, 2002

  Please note that search-term pricing does apply when
  conducting SmartSELECT searches.

Crossover limits have been increased.  See HELP CROSSOVER for details.

Experimental and calculated property data are now available.  See HELP
PROPERTIES for more information.  See STNote 27, Searching Properties
in the CAS Registry File, for complete details:
http://www.cas.org/ONLINE/STN/STNOTES/stnotes27.pdf

=> d his nofile

     (FILE 'HOME' ENTERED AT 15:42:06 ON 29 OCT 2002)

     FILE 'REGISTRY' ENTERED AT 15:42:35 ON 29 OCT 2002
                E TANTALUM/CN
L1            1 SEA TANTALUM/CN

     FILE 'LCA' ENTERED AT 15:43:14 ON 29 OCT 2002

     FILE 'HCA' ENTERED AT 15:52:26 ON 29 OCT 2002
L2       115898 SEA ULTRAPUR? OR (HIGH? OR ULTRA? OR SUPER? OR INCREAS?
                OR RAIS? OR HEIGHT? OR AUGMENT? OR BOOST? OR IMPROV? OR
                ENHANC?)(2A)(PURITY OR PURITIES OR PURIF? OR PURE#)
L3        39851 SEA L1 OR (TANTALUM# OR TA)(2A)(METAL#### OR ELEMENTAL?
                OR FREE# OR UNBOUND? OR NONBOND? OR NON(A)(BOND? OR
                BOUND?) OR TARGET?)

     FILE 'LCA' ENTERED AT 15:55:58 ON 29 OCT 2002
L4         5612 SEA (PARTICL? OR MICROPARTICL? OR PARTICULAT? OR DUST?
                OR GRIT? OR GRAIN# OR GRANUL? OR POWDER? OR SOOT? OR
                SMUT? OR FINES# OR PRILL? OR FLAKE# OR PELLET? OR
                BB#)/BI,AB
L5          830 SEA (PARTICL? OR MICROPARTICL? OR PARTICULAT? OR DUST?
                OR GRIT? OR GRAIN# OR GRANUL? OR POWDER? OR FINES# OR
                PRILL? OR MESH?)(2A)(SIZE# OR SIZING# OR DIA# OR DIAMET?
                OR RADIUS? OR RADII#) OR MESHSIZ?
L6              QUE MICRON# OR MILLIMICRON# OR MICROMETER# OR MU(W)M OR
```

```
                  MUM OR UM OR U(W)M

     FILE 'HCA' ENTERED AT 16:01:12 ON 29 OCT 2002
L7        329978 SEA (PARTICL? OR MICROPARTICL? OR PARTICULAT? OR DUST?
                 OR GRIT? OR GRAIN# OR GRANUL? OR POWDER? OR FINES# OR
                 PRILL? OR MESH?)(2A)(SIZE# OR SIZING# OR DIA# OR DIAMET?
                 OR RADIUS? OR RADII#) OR MESHSIZ?
L8           826 SEA L2 AND L3
L9            44 SEA L8 AND L7
L10            7 SEA L9 AND L6
L11           57 SEA L2(3A)L3
L12            7 SEA L11 AND L7
L13            3 SEA L11 AND L6
L14       126808 SEA SPUTTER? OR GLOWDISCHARG? OR ARCDISCHARG? OR (GLOW?
                 OR ARC OR ARCS OR ARCED OR ARCING#)(2A)DISCHARG?
L15           82 SEA L8 AND L14
L16            5 SEA L9 AND L14
L17           14 SEA L11 AND L14
L18       104665 SEA SPUTTER?
L19           69 SEA L15 AND L18
L20          356 SEA (PURE# OR PURIT? OR PURIF?)(2A)(PERCENT? OR PER(A)CEN
                 T?)
L21            0 SEA L3 AND L20
L22          470 SEA (PURE# OR PURIT? OR PURIF?)(3A)(PERCENT? OR PER(A)CEN
                 T?)
L23            0 SEA L3 AND L22

     FILE 'LCA' ENTERED AT 16:09:55 ON 29 OCT 2002

     FILE 'HCAPLUS' ENTERED AT 16:16:59 ON 29 OCT 2002
L24          103 SEA MICHALUK ?/AU
L25        11219 SEA HUBER ?/AU
L26            4 SEA KAWCHAK ?/AU
L27         1789 SEA MAGUIRE ?/AU
L28            1 SEA L24 AND L25 AND L26 AND L27
                 D ALL

     FILE 'REGISTRY' ENTERED AT 16:24:06 ON 29 OCT 2002
L29            1 SEA 16924-00-8

     FILE 'HCA' ENTERED AT 16:25:02 ON 29 OCT 2002
L30          227 SEA L29
L31          326 SEA (POTASSIUM# OR K)(A)FLUOROTANTALATE# OR K2TAF7
L32           13 SEA L8 AND L31
L33       134011 SEA (ELECTRON OR E)(2A)(BEAM? OR GUN OR GUNS)
L34       453206 SEA VACUUM? OR EVACUAT? OR (LOW OR LOWER? OR REDUC? OR
                 REDN# OR DECREAS? OR LESS? OR DIMINISH?)(2A)(PRESS# OR
                 PRESSUR?)
L35        14218 SEA (L33 OR L34)(3A)(MELT? OR MOLTEN? OR FUSE# OR
                 FUSING# OR FUSION?)
L36           50 SEA L8 AND L35
L37            7 SEA L11 AND L35
```

```
L38            13 SEA L36 AND (L7 OR L6 OR L14)
L39             0 SEA L36 AND L22

     FILE 'LCA' ENTERED AT 16:31:06 ON 29 OCT 2002
L*** DEL       10 S 995%
L40            91 SEA 99(W)(9 OR 95 OR 99 OR 995 OR 999 OR 9995)

     FILE 'HCA' ENTERED AT 16:32:39 ON 29 OCT 2002
L41            47 SEA L8 AND L40
L42             5 SEA L11 AND L41
L43             9 SEA L41 AND L35
L44             0 SEA L41 AND L22
L45            12 SEA L41 AND (L7 OR L6 OR L14)

     FILE 'LCA' ENTERED AT 16:35:16 ON 29 OCT 2002
L46               QUE RECRYST?
                  D HSI

     FILE 'HCA' ENTERED AT 16:36:54 ON 29 OCT 2002
L47            23 SEA L8 AND L46
L48             3 SEA L11 AND L46
L49            15 SEA L47 AND (L35 OR L6 OR L7 OR L14)
L50             0 SEA L47 AND L22
L51            25 SEA L10 OR L12 OR L13 OR L16 OR L37 OR L42 OR L43 OR L48

L52            43 SEA (L17 OR L32 OR L38 OR L45 OR L49) NOT L51
L53         24126 SEA (ULTRAPUR? OR (HIGH? OR ULTRA? OR SUPER? OR INCREAS?
                  OR RAIS? OR HEIGHT? OR AUGMENT? OR BOOST? OR IMPROV? OR
                  ENHANC?)(2A)(PURITY OR PURITIES OR PURIF? OR PURE#))/TI
L54        214013 SEA (PURE# OR PURIT? OR PURIF?)/TI
L55            22 SEA L19 AND L53
L56            25 SEA L19 AND L54
L57            14 SEA L55 NOT (L51 OR L52)
L58             1 SEA L56 NOT (L51 OR L52 OR L57)
L59            15 SEA L57 OR L58
                  D COST

     FILE 'REGISTRY' ENTERED AT 17:02:59 ON 29 OCT 2002

=> file hca
FILE 'HCA' ENTERED AT 17:03:13 ON 29 OCT 2002
USE IS SUBJECT TO THE TERMS OF YOUR STN CUSTOMER AGREEMENT.
PLEASE SEE "HELP USAGETERMS" FOR DETAILS.
COPYRIGHT (C) 2002 AMERICAN CHEMICAL SOCIETY (ACS)
```

FILE COVERS 1907 - 24 Oct 2002 VOL 137 ISS 18
FILE LAST UPDATED: 24 Oct 2002 (20021024/ED)

This file contains CAS Registry Numbers for easy and accurate substance identification.

CAS roles have been modified effective December 16, 2001. Please check your SDI profiles to see if they need to be revised. For information on CAS roles, enter HELP ROLES at an arrow prompt or use the CAS Roles thesaurus (/RL field) in this file.

=> d l51 1-25 cbib abs hitstr hitind

L51 ANSWER 1 OF 25 HCA COPYRIGHT 2002 ACS
136:41037 Affect of localized texture on **sputter** performance of tantalum. Michaluk, C. A.; Smathers, D. B.; Field, D. P. (Cabot Performance Materials, Boyertown, PA, USA). Proceedings of the International Conference on Textures of Materials, 12th, Montreal, QC, Canada, Aug. 9-13, 1999, Volume 2, 1357-1362. Editor(s): Szpunar, Jerzy A. National Research Council of Canada: Ottawa, Ont. (English) 1999. CODEN: 69CAOR.

AB Ta has emerged as the material of choice for the barrier layer for the damascene semiconductor fabrication process. This emerging technol. relies on the reactive **sputtering** of **high -purity Ta targets** to deposit a thin-film of TaN, which then serves as the diffusion barrier between the Si substrate and the Cu conductive paths. Experiences with other materials indicate that the integrity of the deposited film is dependent on the **grain size** and texture of the **sputtering** target. This paper reports recent findings that the **sputtering** performance of Ta is detrimentally influenced by the presence of localized (100) texture banding in the target. Through use of Orientation Imaging Microscopy (OIM), a means of characterizing textural bands and gradients in tantalum was devised. Proper thermomech. processing is shown to be instrumental for eliminating sharp (100) bands and enhancing the texture homogeneity of Ta; these attributes are deemed to be crit. for assuring the performance of **Ta sputtering targets**.

IT **7440-25-7**, Tantalum, processes
(effect of texture on **sputter** performance of Ta)

RN 7440-25-7 HCA

CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

CC 56-8 (Nonferrous Metals and Alloys)

Section cross-reference(s): 76

ST tantalum reactive **sputtering** diffusion barrier texture

IT Reactive **sputtering**
Texture (metallographic)
(effect of texture on **sputter** performance of Ta)

IT Diffusion barrier
(effect of texture on **sputter** performance of Ta used as)

IT **7440-25-7**, Tantalum, processes
(effect of texture on **sputter** performance of Ta)

L51 ANSWER 2 OF 25 HCA COPYRIGHT 2002 ACS

136:23615 **High-purity tantalum sputtering target** having fine-grained microstructure and uniform texture. Turner, Stephen P. (Honeywell International Inc., USA). U.S. US 6331233 B1 20011218, 13 pp. (English). CODEN: USXXAM. APPLICATION: US 2000-497079 20000202.

AB The **Ta sputtering target** having av. **grain size** <100 **.mu.m** and uniform microstructure is manufd. with .gtoreq.3 stages that include a deformation step followed by high-temp. annealing under inert atm. The **sputtering** target is manufd. from the **vacuum -melted** Ta ingot of .gtoreq.**99.95%** purity with <500 ppm of metal impurities. The ingot is typically forged in 3 stages with annealing at: (a) 1500-2800.degree. F for **recrystn.**; (b) 1500-2800.degree. F, preferably 2200-2400.degree. F, esp. to decrease banding in the microstructure; and (c) the final annealing at 1500-2800.degree. F for **recrystn.** to the fine-grained microstructure.

IT **7440-25-7**, Tantalum, uses
(for **sputtering**; **high-purity** Ta for forged **sputtering** target annealed for fine-grained texture)

RN 7440-25-7 HCA

CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

IC ICM C23C014-34

NCL 204298130

CC 56-6 (Nonferrous Metals and Alloys)
Section cross-reference(s): 76

ST tantalum forging **recrystn** uniformity target **sputtering**

IT **Sputtering**
(**Ta**, **target** for; **high-purity** Ta for forged **sputtering** target annealed for fine-grained texture)

IT Annealing
Recrystallization
(of Ta; **high-purity** Ta for forged

sputtering target annealed for fine-grained texture)
IT **7440-25-7**, Tantalum, uses
(for **sputtering**; **high-purity** Ta for
forged **sputtering** target annealed for fine-grained
texture)

L51 ANSWER 3 OF 25 HCA COPYRIGHT 2002 ACS
134:166720 Hot-rolled Ta strip for fabrication of fine-grained targets
for cathodic **sputtering** in electronic applications.
Zhang, Hao (Tosoh SMD, Inc., USA). U.S. US 6193821 B1 20010227, 8
pp. (English). CODEN: USXXAM. APPLICATION: US 1999-353700
19990714. PRIORITY: US 1998-PV97153 19980819.
AB **High-purity** Ta billet is forged to manuf. a
strip with side rolling for transverse redn. of 70-85% from the
centerline (preferably at 25-400.degree.), followed by: (a)
annealing in vacuum at 900-1200.degree.; (b) upset forging the strip
at preferably 25-400.degree. and 90-99% redn. to a plate having
square-section shape; (c) vacuum annealing at 900-1200.degree.; and
(d) machining the annealed plate to manuf. a round
sputtering target. The resulting target has fine
grain size of 20-25 **.mu.m**, and
crystallog., texture suitable for increased **sputtering** in
deposition of uniform Ta films on elec. integrated circuits.
IT **7440-25-7**, **Tantalum**, uses
(**sputtering target**; **Ta**-ingot strip
as fine-grained target for cathodic film **sputtering** on
electronic app.)
RN 7440-25-7 HCA
CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

IC ICM C22F001-18
NCL 148668000
CC 56-11 (Nonferrous Metals and Alloys)
Section cross-reference(s): 76
ST **sputtering tantalum target** manuf ingot
forging; elec circuit **tantalum sputtering**
target manuf
IT Integrated circuits
(Ta films on; Ta-ingot strip as fine-grained target for cathodic
film **sputtering** on electronic app.)
IT **Sputtering targets**
(**Ta**-ingot strip as fine-grained target for cathodic
film **sputtering** on electronic app.)
IT Cast alloys
(Ta; Ta-ingot strip as fine-grained target for cathodic film
sputtering on electronic app.)
IT Forging
(of Ta; Ta-ingot strip as fine-grained target for cathodic film
sputtering on electronic app.)

IT 7440-25-7, **Tantalum**, uses
(**sputtering target**; **Ta**-ingot strip
as fine-grained target for cathodic film **sputtering** on
electronic app.)

L51 ANSWER 4 OF 25 HCA COPYRIGHT 2002 ACS
132:351294 **High-purity** tantalum suitable for powder
alloying and manufacture of cast **recrystallized** strip for
sputtering targets. Michaluk, Christopher A.; Maguire,
James D., Jr.; Kawchak, Mark N.; Huber, Louis E., Jr. (Cabot
Corporation, USA). PCT Int. Appl. WO 2000031310 A1 20000602, 54 pp.
DESIGNATED STATES: W: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY,
CA, CH, CN, CR, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR,
HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU,
LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI,
SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW, AM, AZ, BY,
KG, KZ, MD, RU, TJ, TM; RW: AT, BE, BF, BJ, CF, CG, CH, CI, CM, CY,
DE, DK, ES, FI, FR, GA, GB, GR, IE, IT, LU, MC, ML, MR, NE, NL, PT,
SE, SN, TD, TG. (English). CODEN: PIXXD2. APPLICATION: WO
1999-US27832 19991124. PRIORITY: US 1998-199569 19981125.

AB The Ta powder is manufd. by redn. of suitable salt (esp. K_2TaF_7)
with Na, Mg, or a similar metal, and is purified by **electron
-beam melting** in **vacuum** chambers lined
with refractory metals for the purity .gtoreq.**99**.
995%. The **high-purity** Ta is suitable
for manuf. of **recrystd**. **sputtering** targets
having the av. **grain size** .ltoreq.50 **.mu
.m**. The Ta is also suitable for manuf. of elec.
capacitors, wires, or resistive film layers for integrated circuits.

IT **7440-25-7P**, Tantalum, preparation
(**high-purity** tantalum powder for alloying and
manuf. of **recrystd**. **sputtering** targets)

RN 7440-25-7 HCA
CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

IC ICM C22B034-24
ICS C23C014-34

CC 56-4 (Nonferrous Metals and Alloys)
Section cross-reference(s): 76

ST tantalum powder manuf purifn **vacuum melting**;
sputtering target tantalum purity
recrystn; elec circuit capacitor manuf tantalum purity

IT Refractory metals
(lining, app. with; manuf. of **high-purity**
tantalum powder by salt redn. in high-temp. metal-lined app.)

IT **Electron beams**
(**melting** with; **high-purity** tantalum
powder for melting and manuf. of **recrystd**.
sputtering targets)

IT **Recrystallization**
(of tantalum; **high-purity** tantalum powder for alloying and manuf. of **recrystd. sputtering** targets)
IT Capacitors
(tantalum for; **high-purity** tantalum for manuf. of elec. capacitors and **recrystd. sputtering** targets)
IT **Sputtering**
(tantalum; **high-purity** tantalum powder for alloying and manuf. of **recrystd. sputtering** targets)
IT **7440-25-7P**, Tantalum, preparation
(**high-purity** tantalum powder for alloying and manuf. of **recrystd. sputtering** targets)
IT 7439-89-6, Iron, uses 7439-96-5, Manganese, uses 7440-02-0, Nickel, uses 7440-05-3, Palladium, uses 7440-06-4, Platinum, uses 7440-16-6, Rhodium, uses 7440-18-8, Ruthenium, uses 7440-32-6, Titanium, uses 7440-47-3, Chromium, uses 7440-48-4, Cobalt, uses 7440-58-6, Hafnium, uses 7440-62-2, Vanadium, uses 7440-67-7, Zirconium, uses
(lining, app. with; manuf. of **high-purity** tantalum powder by salt redn. in high-temp. metal-lined app.)
IT 16924-00-8, Potassium fluorotantalate (K2TaF7)
(redn. of; **high-purity** tantalum powder for alloying and manuf. of **recrystd. sputtering** targets)
IT 7440-23-5, Sodium, processes
(redn. with, for tantalum; **high-purity** tantalum powder for alloying and manuf. of **recrystd. sputtering** targets)

L51 ANSWER 5 OF 25 HCA COPYRIGHT 2002 ACS
132:282039 Manufacture of **high-purity** Ti, Zr, V, Nb, and Ta. Azhahzha, V. M.; V'yugov, P. N.; Elenskii, V. A.; Lavrinenko, S. D.; Pilipenko, N. N. (IFTTMT, NNTS KHFTI, Kharkov, Russia). Voprosy Atomnoi Nauki i Tekhniki, Seriya: Vakuum, Chistye Materialy, Sverkhprovodniki (1), 72-76 (Russian) 1998. CODEN: VAVSFN. Publisher: Natsional'nyi Nauchnyi Tsentr "Khar'kovskii Fiziko-Tekhnicheskii Institut".
AB Refining by **electron-beam** and zone **melting** with **vacuum** annealing was applied to manuf. **high-purity** (>99.99 wt.%) T~~i, Zr, V, Nb, and~~ Ta. Impurity contents (including gases), microhardness, elec. resistance, and crystal orientation of the purified metals were detd. The metal impurity contents were 10-5-5 .times. 10-3 wt.%, with C and gases at 10-3-10-2 wt.%. The Ta single crystals of 7-10 mm diam. and 150-180 mm length were obtained by zone refining and vacuum annealing. The purifn. of V was feasible by electrodiffusion method.
IT **7440-25-7P**, Tantalum, preparation
(refining of; manuf. of **high-purity**

refractory metals by **electron-beam melting** and zone refining with vacuum annealing)
RN 7440-25-7 HCA
CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

CC 54-3 (Extractive Metallurgy)
ST titanium purifn **electron beam melting** zone refining; zirconium purifn **electron beam melting** zone refining; vanadium purifn **electron beam melting** electrodiffusion; niobium purifn **electron beam melting** zone refining; tantalum purifn **electron beam melting** zone refining; **electron beam melting** refractory metal zone purifn
IT **Melting**
(**electron-beam**-induced, metal refining by; manuf. of **high-purity** refractory metals by **electron-beam melting** and zone refining with vacuum annealing)
IT Zone melting
(metal refining by; manuf. of **high-purity** refractory metals by **electron-beam melting** and zone refining with vacuum annealing)
IT Electrodiffusion
(metal refining by; manuf. of **high-purity** vanadium by **electron-beam melting** and electrodiffusion)
IT Annealing
(vacuum, in metal refining; manuf. of **high-purity** refractory metals by **electron-beam melting** and zone refining with vacuum annealing)
IT 7440-62-2P, Vanadium, preparation
(refining of; manuf. of **high-purity** refractory metals by **electron-beam melting** and electromigration)
IT 7440-03-1P, Niobium, preparation **7440-25-7P**, Tantalum, preparation 7440-32-6P, Titanium, preparation 7440-67-7P, Zirconium, preparation
(refining of; manuf. of **high-purity** refractory metals by **electron-beam melting** and zone refining with vacuum annealing)

L51 ANSWER 6 OF 25 HCA COPYRIGHT 2002 ACS
130:99188 Billet forging, cold rolling, and recrystallization annealing to manufacture metal plate having uniform texture. Segal, Vladimir (Johnson Matthey Electronics, Inc., USA). PCT Int. Appl. WO 9902743 A1 19990121, 20 pp. DESIGNATED STATES: W: CN, DE, GB, JP, KR, SE, SG; RW: AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC,

NL, PT, SE. (English). CODEN: PIXXD2. APPLICATION: WO 1998-US13447 19980626. PRIORITY: US 1997-52218 19970711.

AB The fine-grained metal plate suitable for a **sputtering** target is manufd. by: (a) hot forging of the metal billet below recrystn. temp., using lubricated billet ends for uniform deformation with 70-90% redn.; (b) cold rolling the cooled plate with the nominal redn. of 10-20%/pass for uniform strain distribution; and (c) heating the plate for recrystn. annealing to form the fine-grained microstructure having uniform texture. **High-purity** Ti ingot was swaged to the rod of 130 mm diam., and cut to form the billet 162 mm long, and the billet was deformed by: (a) upsetting at 350.degree. to the final thickness of 54 mm, using fluoropolymer lubricant as the end coating; and (b) cold rolling at 12%/pass in 8 passes with change of direction, followed by 2-h annealing near 375.degree. for recrystn. to the **grain size** of .apprx.6 **.mu.m**, vs. .apprx.60 **.mu.m** after 2-h annealing at 675.degree..

IT **7440-25-7**, **Tantalum**, uses
(**sputtering**, **targets** for; uniformly textured metal plate targets manufd. from hot-forged billet by cold rolling and recrystn. annealing)

RN 7440-25-7 HCA

CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

IC ICM C21D008-00
ICS C22C005-02; C22C005-04; C22C005-06; C22C009-00; C22C014-00; C22C019-00; C22C021-00; C22C027-00

CC 56-11 (Nonferrous Metals and Alloys)

ST billet forging plate recrystn **sputtering** target; titanium forging plate recrystn **sputtering** target

IT **Sputtering** targets
(metal plates; manuf. of uniformly textured **sputtering** targets from forged metal billet by cold rolling and recrystn. annealing)

IT **7440-25-7**, **Tantalum**, uses 7440-32-6, Titanium, uses
(**sputtering**, **targets** for; uniformly textured metal plate targets manufd. from hot-forged billet by cold rolling and recrystn. annealing)

L51 ANSWER 7 OF 25 HCA COPYRIGHT 2002 ACS

128:119573 Characterization of microblasted and reactive ion etched surfaces on the commercially pure metals niobium, tantalum and titanium. Pypen, C. M. J. M.; Plenk, H., Jr.; Ebel, M. F.; Svagera, R.; Wernisch, J. (Dep. Bone and Biomaterials Res., Histological-Embryological Inst., Univ. Vienna, Vienna, 1090, Austria). Journal of Materials Science: Materials in Medicine, 8(12), 781-784 (English) 1997. CODEN: JSMMEL. ISSN: 0957-4530.

Publisher: Chapman & Hall.

AB In surface-roughened metallic implant materials, the topog., chem. and energy of the surfaces play an important role for the cell and tissue attachment. The **highly** reactive com. **pure metals** niobium, **tantalum** and titanium were analyzed after microblasting (with Al2O3 powder and consecutive shot-peening with ZrSiO2), and after addnl. reactive ion etching (RIE, with CF4). SEM in combination with energy-dispersive X-ray anal. and surface roughness measurements showed, for all microblasted surfaces, a heterogeneous roughening (Ra about 0.7 . **mu.m**), and a contamination with blasting particles. RIE resulted in a further roughening (Ra about 0.7 . **mu.m**), and a contamination with blasting particles. RIE resulted in a further roughening (Ra about 1.1 . **mu.m**), and a total cleaning from contaminations, except for traces of aluminum. Detn. of surface energy by dynamic contact angle measurements showed an increase in surface energy after microblasting, which further increased after RIE, most pronounced for com. pure niobium. In conjunction with superior electrochem. properties, this makes niobium and tantalum promising candidates for implant purposes, at least equal to the generally used titanium.

CC 63-7 (Pharmaceuticals)

L51 ANSWER 8 OF 25 HCA COPYRIGHT 2002 ACS

124:275881 Characteristic improvement of high purity tantalum by doping, and embrittlement mechanism of lead wires of tantalum capacitors. Izumi, Tomoo (Showa Cabot Supermetals K. K., Fukushima, 969-34, Japan). Denkai Chikudenki Hyoron, 46(1), 59-84 (Japanese) 1995. CODEN: DCHYAK. ISSN: 0286-5629. Publisher: Denkai Chikudenki Kenkyukai.

AB 0.02-0.03 Ppm Y2O3-doped Ta ingots are manufd. by an EBM (**electron beam melting** furnace). The amt. of the Y2O3 was measured by a newly developed method. The Y2O3 prevented the **recrystn.** or abnormal crystal growth of the Ta at >1500.degree.. A Ta capacitor having a pure Ta lead wire or a Y2O3-doped Ta lead wire was prep. by sintering Ta powder at >1500.degree., when the Ta lead wires were embrittled under a condition. The crystal **grain size** of the embrittled Ta lead wire, and the behavior of the O2 in the Ta powder, was obsd. When the Ta powder was sintered, the O2 in the Ta powder diffused from the Ta powder to the Ta wire. Based on the observation, the mechanism and cause of the embrittlement of the Ta lead wire was probed.

IT **7440-25-7**, Tantalum, uses
 (characteristic **improvement** of high **purity** tantalum by doping, and embrittlement mechanism of lead wires of tantalum capacitors)

RN 7440-25-7 HCA

CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

CC 76-10 (Electric Phenomena)
IT **7440-25-7**, Tantalum, uses
(characteristic **improvement** of high **purity** tantalum by doping, and embrittlement mechanism of lead wires of tantalum capacitors)

L51 ANSWER 9 OF 25 HCA COPYRIGHT 2002 ACS
117:255887 Characterization of extruded and forged tantalum powder metallurgy preforms. Michaluk, Christopher A.; Asfahani, Riad I.; Hughes, Douglas C. (Cabot Corp., Boyertown, PA, 19512, USA). High Strain Rate Behav. Refract. Met. Alloys, Proc. Symp., Meeting Date 1991, 27-44. Editor(s): Asfahani, Riad; Chen, Edward; Crowson, Andrew. Miner. Met. Mater. Soc.: Warrendale, Pa. (English) 1992. CODEN: 58GCAL.
AB A technique for producing a tantalum bar stock contg. a fine, uniform **grain size** is presented. Several 1.625 in.-diam. bars with different oxygen contents were manufd. by warm extrusion of **high-purity tantalum metal** powder. The fully dense, as-extruded rods were characterized by their response to annealing (**grain size** and mech. properties). Forgeability studies were conducted on selected bar lengths; the effects of oxygen content, annealing, and workpiece temp. on the forgeability of the rotary pieces were detd. Finally, quasistatic tensile testing was conducted on annealed disks to det. the effect of oxygen level, strain rate, and temp. on the deformation behavior of the rotary forged powder-metallurgy liner preform.
CC 56-4 (Nonferrous Metals and Alloys)

L51 ANSWER 10 OF 25 HCA COPYRIGHT 2002 ACS
115:238053 Densification studies of refractory materials using hot isostatic pressing (HIP) and tantalum containment. Hoenig, Clarence; Otto, Ralph; Stutler, William (Lawrence Livermore Natl. Lab., Livermore, CA, 94551, USA). Materials Science Monographs, 66B(Ceram. Today--Tomorrow's Ceram., Pt. B), 1337-45 (English) 1991. CODEN: MSMODP. ISSN: 0166-6010.
AB Powders of cryst. rhombohedral B were HIP processed to near-full d. at 1500-1800.degree. and 206.8 MPa. At 1700.degree., the densification of B was independent of **particle size** in the range of <37 **.mu.m** to 10 mm. At 1500.degree. only the <37-**.mu.m** powder reached near-full d. Si and Ca impurities segregate in the grain boundaries during densification. Results indicate that plastic yielding was the dominate densification mechanism. B nitride powder with 0.97% O content was pressed to a d. of 2.21 g/cm3 at 1800.degree. and 206.8 MPa. The d. of **high-purity** hot-pressed graphite was increased by 15% to 2.10 g/cm3 at 220.degree. and 206.8 MPa. These results show that refractory metal

containers used in hot isostatic pressing significantly expand the availability of **high**-d. **high-purity**
materials.
IT **7440-25-7**, Tantalum, uses and miscellaneous
(container, in hot isostatic pressing)
RN 7440-25-7 HCA
CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

CC 57-2 (Ceramics)
IT **7440-25-7**, Tantalum, uses and miscellaneous
(container, in hot isostatic pressing)

L51 ANSWER 11 OF 25 HCA COPYRIGHT 2002 ACS
113:156564 Manufacture of clean steel using controlled deoxidation and basic refractories. Ototani, Tohei (Metal Research Corp., Japan). U.S. US 4944798 A 19900731, 8 pp. (English). CODEN: USXXAM. APPLICATION: US 1989-363570 19890607. PRIORITY: JP 1989-20817 19890201.
AB The **high-purity** steels (contg. O and S <30 each, N <150, Mg 0.1-5, and Ca 0.1-25 ppm) are manufd. in a refractory-lined furnace or ladle by deoxidizing the **melt** in **vacuum** or a nonoxidizing atm. with 0.01-0.5% Al and Ti, Nb, Ta, B, and/or alk.-earth metal; or 0.001-0.1% Ca or Ca alloy (added as Ca-cored Fe wire). The deoxidizing addn. optionally includes <5% flux as alkali or alk.-earth metal halide, carbide, or carbonate. The basic refractory linings in furnaces or ladles contain CaO 7-90, MgO 7-90 with CaO + MgO 70-**99.9**
, and Al2O3, Cr2O3, ZrO2.SiO2, ZrO2, SiO2, ZrC, and/or C 0.1-30%. Thus, molten low-C steel in a vacuum ladle was deoxidized with Al and degassed for continuous casting. The ladle lining consisted of CaO 56, MgO 25, and Cr2O3 18%. The degassed steel was treated with Ca-Si clad Fe wire contg. Fe 55, Ca 14.4, and Si 27%. The resulting steel showed <30 ppm each of O, S, N, Ca, and Mg.
IT **7440-25-7**, Tantalum, uses and miscellaneous
(in refining of molten steel deoxidn. with aluminum and)
RN 7440-25-7 HCA
CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

IC ICM C21C007-02
NCL 420085000
CC 55-1 (Ferrous Metals and Alloys)
Section cross-reference(s): 57
IT 7440-03-1, Niobium, uses and miscellaneous **7440-25-7**, Tantalum, uses and miscellaneous 7440-32-6, Titanium, uses and miscellaneous 7440-42-8, Boron, uses and miscellaneous 7440-45-1, Cerium, uses and miscellaneous 7440-67-7, Zirconium,

uses and miscellaneous
(in refining of molten steel deoxidn. with aluminum and)

L51 ANSWER 12 OF 25 HCA COPYRIGHT 2002 ACS
113:88790 Titanium-added **high-purity** **tantalum** sintered sputtering **targets**. Sawada, Susumu; Wada, Hironori; Ashida, Koji (Nippon Mining Co., Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 01290766 A2 19891122 Heisei, 6 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1988-119079 19880518.

AB The target is made from Ta **99.999**-99.9999% in purity to which 0.1-2 at.% Ti is added, and produced by mixing of powders of TaH2 and TiH2 which are prepd. by hydrogenation of **electron beam-fused** metals, dehydrogenation, and sintering of the powder mixt., and annealing of the sinter. The target produces a Ta2O5 film in which O-defects are compensated by Ti.

IC ICM C23C014-34
ICS B22F009-04; B22F009-30; C22C001-04

CC 75-2 (Crystallography and Liquid Crystals)
Section cross-reference(s): 56

ST titanium added **tantalum** sintered sputtering **target**

IT Sputtering
(app., targets, sintered, from titanium-added **high-purity** tantalum)

IT 1314-61-0, Tantalum oxide (Ta2O5)
(sputter deposition of, titanium-added **high-purity** **tantalum** **targets** for)

L51 ANSWER 13 OF 25 HCA COPYRIGHT 2002 ACS
113:62941 Manufacture of **high-purity** tantalum or niobium. Mizusaki, Yujiro; Izawa, Hirosumi; Hanawa, Kenzo; Saito, Hiroshi (Showa Denko K. K., Japan; Showa Cabot Supermetals K. K.). Jpn. Kokai Tokkyo Koho JP 01222028 A2 19890905 Heisei, 6 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1988-48279 19880229.

AB Powd. Ta or Nb of **particle size** 100-500 **mu.m** is heated at 200-600.degree. in Ar-(9-50 vol.%) halogen to prep. Ta or Nb halide vapor, which is then reduced with H at 800-1100.degree.. The obtained **high-purity** Ta or Nb is used for high-temp. or corrosion-resistant materials, e.g., electrolytic capacitors.

IT **7440-25-7P**, Tantalum, preparation
(manuf. of **high-purity**, by hydrogen redn. of halides)

RN 7440-25-7 HCA

CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

IC ICM C22B034-24

CC 54-2 (Extractive Metallurgy)

Section cross-reference(s): 76
IT 7440-03-1P, Niobium, preparation **7440-25-7P**, Tantalum, preparation
(manuf. of **high-purity**, by hydrogen redn. of halides)

L51 ANSWER 14 OF 25 HCA COPYRIGHT 2002 ACS
109:42234 Manufacture of active metal ingot from metal oxide powder.
Ozeki, Akiya; Kosuge, Shigechika; Nakada, Kiyokazu; Watanabe, Itaru; Sakata, Naoki; Mizukami, Hideaki; Kato, Akira; Izawa, Tomoo (Nippon Kokan K. K., Japan). Jpn. Kokai Tokkyo Koho JP 63062828 A2 19880319 Showa, 4 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1986-205302 19860901.
AB The ingot of an active metal (Ti, Si, Nb, or Ta) is produced from a **high-purity** metal oxide powder by redn. with C and casting. For redn., the powd. metal oxide is briquetted with powd. C in the presence or absence of a hydrocarbonic binder, and the briquets are **fused** with an **electron beam**. Thus, briquets of a 1:1 powder mixt. of 99%-pure TiO2 and **99.9%** C were charged into molten Ti in a water-cooled Cu crucible in vacuum chamber at 10-2 torr. The melt was heated to .apprx.1800.degree. by top scanning with an electron beam, and then overflowed into an ingot mold to obtain **99.9%** Ti ingots.
IT **7440-25-7**, Tantalum, reactions
(redn. casting ingot of, from briquets contg. powd. titania and carbon, electron beam scanning in)
RN 7440-25-7 HCA
CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

IC ICM C22B009-22
ICS C22B034-12; C22B034-24
CC 56-2 (Nonferrous Metals and Alloys)
IT Electron beam, chemical and physical effects
(fusion with scanned, of metal oxide powder briquets in molten metal, for **high-purity** active metal ingot casting)
IT Casting process
(ingot, of active metal, oxide redn. with carbon under **fusion** with **electron beam** in)
IT Briquets
(of metal oxide and carbon powders, redn. casting of, for **high-purity** active metal ingot)
IT 13463-67-7P, Titania, preparation
(briquets contg. powd. carbon and, for redn. casting under **fusion** with **electron beam**, **high-purity** titanium ingot by)
IT 7440-03-1, Niobium, reactions 7440-21-3, Silicon, reactions **7440-25-7**, Tantalum, reactions 7440-32-6, Titanium,

reactions
(redn. casting ingot of, from briquets contg. powd. titania and carbon, electron beam scanning in)
IT 7440-44-0, Carbon, reactions
(redn. with powd., of briquetted metal oxide under **fusion** with **electron beam**, for **high-purity** metal ingot)

L51 ANSWER 15 OF 25 HCA COPYRIGHT 2002 ACS
108:136233 Sputtering target from tantalum by sintering. Kyono, Iwao; Hosaka, Hiroshi; Yaegashi, Seiji (Nippon Mining Co., Ltd., Japan). PCT Int. Appl. WO 8707650 A1 19871217, 27 pp. DESIGNATED STATES: W: DE, US. (Japanese). CODEN: PIXXD2. APPLICATION: WO 1987-JP365 19870609. PRIORITY: JP 1986-133802 19860611.
AB The sputtering target for forming high-quality Ta2O5 elec. insulating films and metallic Ta electrode films is manufd. from purified Ta contg. alkali metals .ltoreq.0.05, radioactive elements .ltoreq.0.005, and transition metals .ltoreq.3 ppm. The metallic Ta is prepd. from an acid-dissolved Ta compd. by forming K2TaF7 crystals for redn. with Na and then drying. Thus, 11 kg Ta2O5 powder was dissolved in 18 kg aq. 50% HF at 80.degree., and the soln. was filtered with pore size of 0.2.mu.. The filtrate was mixed with 3 kg pure KCl in 18 L tap water at 80.degree., and then with 6 L of slowly added Ta salt. K2TaF7 was pptd., filtered, washed with aq. 100 g KF/L, dried, and then reduced with Na at 800.degree. to form powd. Ta, KF, and NaF. The Ta powder was cold-pressed at 1500 kg/cm2, hot-isostatically pressed 1 h at 1000 kg/cm2 and 1400.degree., and then **melted** with an **electron beam** to obtain a Ta target contg. <1 ppm each of Nb, Mo, W, and Zr.
IC ICM C23C014-34
CC 56-4 (Nonferrous Metals and Alloys)
Section cross-reference(s): 76
IT Sputtering
(**tantalum target** for, **high-purity** powder for sintered)
IT 16924-00-8, Potassium tantalum fluoride (K2Taf7)
(redn. of, with sodium, for **high-purity tantalum** sputtering **target**)
IT 7440-23-5, Sodium, reactions
(redn. with, of potassium-tantalum fluoride, in manuf. of **high-purity tantalum** sputtering **target**)

L51 ANSWER 16 OF 25 HCA COPYRIGHT 2002 ACS
103:219496 Effect of alloying elements on the structure and properties of aluminum at high solidification and cooling rates. Kudinov, V. V.; Kalita, V. I.; Kopteva, O. G. (Moscow, USSR). Fiz. Khim. Obrab. Mater. (5), 57-64 (Russian) 1985. CODEN: FKOMAT. ISSN: 0015-3214.
AB Elec. resistivity, **grain size**, and microhardness of binary solid solns. based on high-purity Al (A999) alloyed with B, Si, Sc, Ti, V, Cr, Mn, Fe, Co, Ni, Y, Zr, Nb, Mo, Ce, Hf, Ta, and

W 0.003-0.06 at.% were studied at high rates of solidification and cooling. Alloying elements with ionization potential higher than that of Al contributed to a microhardness increase insignificantly, whereas solid solns. with Ce, Y, Co, and Ni (the difference between their and Al at. radius 12-27%) had microhardness 320-360 MPa; microhardness of sprayed (on Cu drums) high-purity Al being 200 MPa. A noticeable disintegration of grains in the plane parallel to the deposition surface was obsd. in alloys with Fe, Co, Ni, Y, Ce, and Hf (at. radius difference 11-27%), i.e. 0.8-1.2 .mu.. The 1.9-3.2 .mu. grains were present in alloys with Ti, V, Nb, Mo, Ta, and W (the at. radius difference 1-5%).

IT **7440-25-7**, properties
(in **high-purity** aluminum, structure and properties at high solidification and cooling rates in relation to)

RN 7440-25-7 HCA

CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

CC 56-12 (Nonferrous Metals and Alloys)
Section cross-reference(s): 76

IT 7439-89-6, properties 7439-96-5, properties 7439-98-7, properties 7440-02-0, properties 7440-03-1, properties 7440-20-2, properties 7440-21-3, properties **7440-25-7**, properties 7440-32-6, properties 7440-33-7, properties 7440-42-8, properties 7440-45-1, properties 7440-47-3, properties 7440-48-4, properties 7440-58-6, properties 7440-62-2, properties 7440-65-5, properties 7440-67-7, properties
(in **high-purity** aluminum, structure and properties at high solidification and cooling rates in relation to)

L51 ANSWER 17 OF 25 HCA

103:219312 Manufacture of pure vanadium. Part II: refining of vanadium-aluminum alloys with at least **99.9**% vanadium by **electron beam melting**.

Haehn, R.; Krueger, J. (GfE Gesellschaft fur Elektrometall. m.b.H., Werk Nuernberg, Fed. Rep. Ger.). Metall (Berlin), 39(10), 931-2, 935-6 (German) 1985. CODEN: MTLLAF. ISSN: 0026-0746.

AB V-Al alloys (85% V) obtained by aluminothermic redn. of pure V2O5 and V2O3 in a Cu mold were refined in an electron-beam furnace at 10-4-10-6 mbar to .gtoreq.**99.9**%-purity V. The impurities, such as Ca, Mo, Al, Fe, and Cr are removed by evapn. due to their higher vapor pressure than V. N, Si, Ti, Zr, and high m.p. **metals** (W, Mo, **Ta**, Nb) are hardly or not removed. The evapn. kinetics of impurities are calcd. based on the activity and thermodn. The final Al and O contents were 0.036 and 0.0157%, resp. No decarburization by CO takes place at a C .times. 0 product of <4 .times. 10-3. A very pure charge of V oxides and Al granules

is recommended to **increase** the V **purity** after 3
electron-beam meltings to 99.91%.
CC 56-1 (Nonferrous Metals and Alloys)
Section cross-reference(s): 54

L51 ANSWER 18 OF 25 HCA COPYRIGHT 2002 ACS
93:99184 Production of **high purity** electronic materials at special materials plant. Damodaran, A. D.; Taneja, A. K.; Jain, S. C.; Rao, T. V. (Spec. Mater. Plant, Nucl. Fuel Complex, Hyderabad, 500 762, India). Prepr. - Int. Conf. Adv. Chem. Metall., Volume 2, Paper 45, 32 pp.. Bhabha At. Res. Cent., Bombay, India. (English) 1979. CODEN: 43MVAS.
AB The prodn. of **high-purity** materials (esp. **99.99** Ta and **99.999%** Se) for the electronics industry is described. The many methods used are briefly discussed.
IT **7440-25-7P**, preparation
(prodn. of **high-purity**, for electronics)
RN 7440-25-7 HCA
CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

CC 54-3 (Extractive Metallurgy)
Section cross-reference(s): 49
IT Electronics
(metals for, prodn. of **high-purity**)
IT Metals, preparation
(prodn. of **high-purity**, for electronics)
IT **7440-25-7P**, preparation 7782-49-2P, preparation
(prodn. of **high-purity**, for electronics)

L51 ANSWER 19 OF 25 HCA COPYRIGHT 2002 ACS
87:10127 Tantalum metal powder. Bates, Victor T.; Fry, Stanley S.; Hakko, James B. (Fansteel, Inc., USA). U.S. US 4017302 19770412, 13 pp. (English). CODEN: USXXAM. APPLICATION: US 1976-655159 19760204.
AB Improved, high-purity agglomerated Ta powders are characterized by exceptionally high green strength when pressed without using a carbonaceous binder into low d. anodes and high elec. capacitance along with low d.c. leakage and dissipation factor in the anodes after sintering. Such powder is produced by milling hydrided **high-purity Ta metal** ingots or powder to a crit. **particle size powder**, subjecting the powder to a 2-step heat treatment to degas and pre-agglomerate it, screening and milling the oversize portion of the degassed and pre-agglomerated powder to achieve intermediate **mesh size powder**, subjecting this powder to a higher temp. treatment to agglomerate it, milling the agglomerated powder to an intermediate mesh fraction, screening the powder to remove the fine **particle size** portion,

subjecting this fine particle material to an addnl. heat treatment to re-agglomerate it, and blending the re-agglomerated fines with the coarser **mesh size** portions of the agglomerated powder.

IT **7440-25-7**, properties
(**high-purity** powd., for capacitors)

RN 7440-25-7 HCA

CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

IC B22F001-04

NCL 75-.5BB

CC 56-3 (Nonferrous Metals and Alloys)

IT **7440-25-7**, properties
(**high-purity** powd., for capacitors)

L51 ANSWER 20 OF 25 HCA COPYRIGHT 2002 ACS

84:153579 Nitride intermediates in the preparation of niobium, vanadium, and **tantalum metals**. 2. Thermal decomposition of the nitrides. Guidotti, R. A.; Atkinson, G. B.; Kesterke, D. G. (Reno Metall. Res. Cent., Reno, Nev., USA). U. S., Bur. Mines, Rep. Invest., RI 8103, 15 pp. (English) 1976. CODEN: XBMIA6.

AB The thermal decompn. of NbN, Ta_3N_5, and VN, for the prepn. of **high-purity** metals is discussed. Nb metal of > **99.9%** purity is prepd. by the solid-state thermal decompn. of NbN at .gtoreq.1850.degree. under vacuum, and by **electron-beam melting**. Ta of >99.6% purity is prepd. by the vacuum thermal decompn. of Ta_3N_5 at .gtoreq.1900.degree. or by arc melting under He or partial vacuum. By **electron-beam melting**, a purity of >99.9% is attainable. VN is not amenable to treatment by the melting techniques because of the high vapor pressure of the metal and the unfavorable kinetics of N degassing. By using V_2N as an anode, molten-salt electrorefining produces a metal deposit with a purity comparable to Nb and Ta.

IT **7440-25-7P**, preparation
(from nitride, by thermal decompn.)

RN 7440-25-7 HCA

CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

CC 54-2 (Extractive Metallurgy)

IT 24621-21-4
(decompn. of, for **high-purity** niobium)

IT 12033-94-2
(decompn. of, for **high-purity** tantalum)

IT 12209-81-3
(electrolysis of, for **high-purity** vanadium)

IT 7440-03-1P, preparation **7440-25-7P**, preparation
(from nitride, by thermal decompn.)

L51 ANSWER 21 OF 25 HCA COPYRIGHT 2002 ACS
83:154234 Nuclear fuel complex. Integrated approach to fuel fabrication. Katiyar, H. C. (Nucl. Fuel Complex, Hyderabad, India). Proc. Symp. Nucl. Sci. Eng., 385-415. Bhabha At. Res. Cent.: Bombay, India. (English) 1973. CODEN: 31DBAY.

AB The title complex has been set up for the manuf. of reactor fuel and related Zircaloy-2 [11068-94-3] hardware. The complex covers the entire range of operations from processing of raw material concs. to finishing of fuel element assemblies and other Zircaloy reactor components. In addn. the complex produces **ultrapure** (electronic grade) materials, **micron-size** Zr [7440-67-7] **powder** (1 ton/yr), Ti [7440-32-6], and seamless stainless steel tubes (initially 2000 tons/yr). The prodn. of nuclear grade materials has begun. Calandria tubes and prototype fuel bundles have been fabricated. The project has also produced Zr powder and electronic grade Ta anodes, Cd, Bi, In, and Sn.

IT **7440-25-7P**, preparation
(at nuclear reactor fuel fabrication facility)

RN 7440-25-7 HCA

CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

CC 71-6 (Nuclear Technology)
Section cross-reference(s): 76, 49, 55, 56

IT 1314-23-4P, preparation 1344-57-6P, preparation **7440-25-7P**, preparation 7440-31-5P, preparation 7440-32-6P, preparation 7440-67-7P, preparation 7440-69-9P, preparation 7440-74-6P, preparation 7664-93-9P, preparation 7697-37-2P, preparation
(at nuclear reactor fuel fabrication facility)

L51 ANSWER 22 OF 25 HCA COPYRIGHT 2002 ACS
81:178356 **Highly pure** inorganic substances. Mraz, Jiri Czech. CS 153944 19740615, 3 pp. (Czech). CODEN: CZXXA9. APPLICATION: CS 1972-5979 19720831.

AB Products of purity >**99.9**%, which are useful in nuclear technol., were prepd. by melt refining and crystal pulling from the melt. Granulated Ta, Mo, or Ge was thus **melted** in an **electron beam** and the **melted** metal allowed to drip into a cooled crystallizer at conditions which facilitated removal of gases and contaminants in the foam. The product was remelted by the zone technique or a single crystal pulled from the melt by the cooled crucible method.

IT **7440-25-7**, properties
(crystal growth of, from melt)

RN 7440-25-7 HCA

CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

IC G21G
CC 70-1 (Crystallization and Crystal Structure)
IT 7439-98-7, properties **7440-25-7**, properties 7440-56-4, properties
(crystal growth of, from melt)

L51 ANSWER 23 OF 25 HCA COPYRIGHT 2002 ACS
80:9785 Hydrogen liberation overvoltage on various faces of a **highly pure** tantalum single crystal. Kopalin, N. G.; Kudryashov, I. V.; Makolkin, I. A. (Inst. Nar. Khoz. im. Plekhanova, Moscow, USSR). Zh. Fiz. Khim., 47(8), 2135-6 (Russian) 1973. CODEN: ZFKHA9.
AB Overvoltage and effective activation energy, Eeff, for the H evolution reaction on various faces of a Ta single crystal decrease in 0.1N H_2SO_4 with increased heat of adsorption of H in the order: (110) > (100) > (111). The amt. of adsorbed H decreases and the overvoltage on particular faces increases in the order: (111) > (100) > (110) > polycrystal ~~(99.995% pure)~~. Heats of adsorption of H for all faces decrease with increased current flow in the surface finishing process. A different mechanism for the H evolution reaction on the (110) face is suggested on the basis of an unusual overvoltage value. The a and b of the Tafel equation and Eeff for particular faces of single crystal and for poly-crystal are given.
IT **7440-25-7**, properties
(overvoltage on, **highly pure** single crystal, heat of adsorption of hydrogen in relation to)
RN 7440-25-7 HCA
CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

CC 77-7 (Electrochemistry)
IT Overvoltage
(on tantalum **highly pure** single crystal, heat of adsorption of hydrogen in relation to)
IT **7440-25-7**, properties
(overvoltage on, **highly pure** single crystal, heat of adsorption of hydrogen in relation to)

L51 ANSWER 24 OF 25 HCA COPYRIGHT 2002 ACS
75:100181 **High-purity tantalum metal**. Wilhelm, Harley A.; Schmidt, Frederick A.; Bergman, Roger M. (United States Atomic Energy Commission). U.S. US 3597192 19710803, 3 pp. (English). CODEN: USXXAM. APPLICATION: US 19681205.
AB **High-purity Ta metal** is obtained by the aluminothermic redn. of Ta_2O_5. E.g., a 21/2 in.

internal diam. Fe redn. bomb was prepd. by jolt packing an Al2O3 liner 1/4 in. thick on the sides and 1/2 in. on the bottom using a mandrel. A redn. charge was prepared by mixing 250 g Ta2O5, 3.4 g Si, 39 g KClO3, and 73.2 g powd. Al. The charge was placed in the bomb, topped with Al2O3, and the bomb capped. It was placed in a gas furnace preheated at 250.degree. and the bomb was then heated to ignition (1000.degree.). After completion of reaction and cooling, the bomb was opened and the metal button was sepd. from the slag. The button contained Al 2.8, Si 1.6, and Ta 96%. It was purified by **electron beam melting** to a **high -purity** ductile **Ta metal** having a diamond-point hardness of 76-8. By emission spectroscopy, the metal was found to contain <100 ppm Si. No Al was detected.

IC C22B

NCL 075084000

CC 54 (Extractive Metallurgy)

IT 7440-25-7P, preparation
(from oxide, by aluminothemic redn. and **electron beam melting**)

L51 ANSWER 25 OF 25 HCA

69:21247 Production of tantalum metal by aluminothermic reduction of its pentoxide. Gupta, C. K.; Jena, P. K. (Met. Div., Bhaba At. Res. Centre, Bombay, India). J. Metals, 20(5), 25-8 (English) 1968. CODEN: JOMTAA.

AB A method is given for obtaining massive Ta metal through aluminothermic redn. of Ta2O5 by triggering the reaction with the help of small amts. of Ca and S at a comparatively low temp. of .apprx.450.degree., and using a suitable charge compn. to form a low-melting slag of Al2O3-Al2S3. With charges of 500 g. Ta2O5, the yield was 88%. **High-purity**, ductile **Ta metal** was produced from this metal by the combination of non-consumable arc- and **electron-beam melting**. In view of the lower cost of the reductant, high yield, and the obvious exptl. advantages of the aluminothermic redn. over Ca and Mg redns., the process appears attractive. The materials Ta2O5, Al, and S used in the process are easy to handle compared with the hygroscopic fluoride and reactive Na. The com. Na redn. and the electrolytic processes yield initially powdery or dendritic material which needs purification and consolidation. In the proposed process, a clear slag-metal sepn. results in a massive metal with only Al as a major impurity, which is easily eliminated by arc- and **electron-beam melting**. Since the reactions appear free from hazard, the process can be easily scaled up to an economical batch size.

CC 54 (Extractive Metallurgy)

ST **electron beam melting** redn Ta; tantalum prodn; aluminothermic redn Ta pentoxide; thermite redn Ta pentoxide; arc melting redn Ta

=> d l52 1-43 cbib abs hitstr hitind

L52 ANSWER 1 OF 43 HCA COPYRIGHT 2002 ACS
137:173282 Forged refractory metal plates with uniform texture suitable for manufacture of **sputtering** targets. Jepson, Peter R.; Uhlenhut, Henning; Kumar, Prabhat (H.C. Starck, Inc., USA). U.S. Pat. Appl. Publ. US 2002112789 A1 20020822, 12 pp. (English). CODEN: USXXCO. APPLICATION: US 2002-79286 20020220. PRIORITY: US 2001-PV269983 20010220.

AB The **high-purity** Ta or Nb billets for manuf. of **sputtering** targets are processed by cutting the billet to short length, and pressing or forging along alternating orthogonal axes with intermediate annealing and **recrystn.** to manuf. the plates having fine-grained microstructure and uniform texture. The **sputtering** targets are manufd. by machining the plates .gtoreq.0.8 in. thick to the final shape. The uniform texture promotes the **sputtering** deposition with a predictable rate and controlled film thickness.

IT **7440-25-7, Tantalum**, uses
(**sputtering targets**; forged refractory metal plates with uniform texture for **sputtering** targets)

RN 7440-25-7 HCA

CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

IC ICM C22C027-02
ICS C23C014-34; C21C001-00

NCL 148422000

CC 56-11 (Nonferrous Metals and Alloys)

ST tantalum billet forging plate **sputtering** target manuf; niobium billet forging plate **sputtering** target manuf

IT **Sputtering** targets
(forged refractory metal plates with uniform texture for **sputtering** targets)

IT **Recrystallization**
(of **sputtering** targets; forged refractory metal plates with uniform texture for **sputtering** targets)

IT 7440-03-1, Niobium, uses **7440-25-7, Tantalum**, uses
(**sputtering targets**; forged refractory metal plates with uniform texture for **sputtering** targets)

L52 ANSWER 2 OF 43 HCA COPYRIGHT 2002 ACS
137:14912 Determination of trace phosphorus in high purity tantalum materials by inductively coupled plasma mass spectrometry subsequent to matrix separation with on-line anion exchange/coprecipitation. Kozono, Shuji; Takahashi, Shigeto; Haraguchi, Hiroki (Showa Denko K.K., Analysis and Physical Properties Center, Chiba, 267-0056, Japan). Analytical and Bioanalytical Chemistry, 372(4), 542-548 (English) 2002. CODEN: ABCNBP. ISSN: 1618-2642. Publisher: Springer-Verlag.

AB An online matrix sepn./inductively coupled plasma mass spectrometry (ICP-MS) method is proposed for the detn. of trace amts. of P in **high purity Ta metal**, **Ta**(V) oxide, and Ta pentaethoxide. In the present method, the matrix Ta in the sample soln. was adsorbed on the anion exchange resin, and P (phosphate ion) was eluted with the carrier soln. of HF and HNO3 mixt. Then, the effluent soln. was subsequently mixed with Bi soln. and aq. NH3 soln. to coppt. phosphate together with Bi hydroxide. The ppt. formed was collected on the in-line membrane filter to wash out HNO3 with pure H2O, and then dissolved with HCl. The obtained P sample soln. was introduced directly into the nebulizer of ICP-MS for the detn. of P. P was detd. at the mol. ion signal of 31P16O+ (m/z 47). The detection limit (3.sigma.) of P in the present method was 1.3 ng mL-1 as the sample soln. basis, and the relative std. deviation for 30 ng mL-1 of P in the std. soln. was 4.3% in the replicate measurements (n = 11). The present method was applied to the anal. of high purity Ta materials. The concns. of P in Ta samples were in fairly good agreement with those obtained by **glow discharge** mass spectrometry (GDMS).

CC 79-6 (Inorganic Analytical Chemistry)

L52 ANSWER 3 OF 43 HCA COPYRIGHT 2002 ACS

136:203860 Manufacture of tantalum and niobium powders of **high purity** for capacitors. Kolosov, V. N.; Matychenko, E. S.; Orlov, V. M.; Prokhorova, T. Yu.; Miroshnichenko, M. N. (Institut Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya im I. V. Tananaeva Kol'skogo Nauchnogo Tsentra Ran, Russia). Russ. RU 2164194 C2 20010320, No pp. given (Russian). CODEN: RUXXE7. APPLICATION: RU 1999-110283 19990511.

AB The Ta or Nb salts mixed with the alkali metal halide and active additives are charged in a reactor made of nickel alloy; the mixt. is melted, and the metals of interest are reduced in an inert gas atm. The active additives are used in the form of rectifying metal powder in the amt. of 0.3-3.0% of the rectifying metal salt wt. in the melt, and its interaction with the melt and reactor material results in formation of intermetallic protective coating on the reactor internal surface. In the preferred embodiment, the alkali metal halide is NaCl or KCl. The method provides a decrease in powder contamination by the metallic impurities from the reactor container by the factor of 3-5, by oxygen - of 1.5-2.0 with the powder surface increased by 10-40%.

IT **7440-25-7P**, Tantalum, preparation
(manuf. of tantalum and niobium powders of **high purity** for capacitors)

RN 7440-25-7 HCA

CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

IC ICM B22F009-18
ICS C22B034-24

CC 56-4 (Nonferrous Metals and Alloys)
IT Capacitors
(manuf. of tantalum and niobium powders of **high purity** for)
IT Coating process
(of reactor container for manuf. of tantalum and niobium powders of **high purity** for capacitors)
IT Powders
(of tantalum and niobium of **high purity** for capacitors, manuf.)
IT 7440-03-1P, Niobium, preparation **7440-25-7P**, Tantalum, preparation
(manuf. of tantalum and niobium powders of **high purity** for capacitors)
IT 16924-00-8, Potassium tantalum fluoride (**K2TaF7**) 16924-03-1, Niobium potassium fluoride (NbK2F7)
(precursor; manuf. of tantalum and niobium powders of **high purity** for capacitors)
IT 12034-55-8, NbNi 12034-56-9 12035-68-6 12035-73-3
(reactor coating; manuf. of tantalum and niobium powders of **high purity** for capacitors)
IT 7440-02-0, Nickel, processes 401572-92-7
(reactor material; manuf. of tantalum and niobium powders of **high purity** for capacitors)
IT 7447-40-7, Potassium chloride (KCl), processes 7647-14-5, Sodium chloride, processes
(reducing agent; manuf. of tantalum and niobium powders of **high purity** for capacitors)

L52 ANSWER 4 OF 43 HCA COPYRIGHT 2002 ACS
136:192820 **Sputtering** targets. Watanabe, Koichi; Suzuki, Yukinobu; Kosaka, Yasuo; Ishigami, Takashi (Toshiba Corp., Japan). Jpn. Kokai Tokkyo Koho JP 2002060934 A2 20020228, 7 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 2000-254477 20000824.
AB **High-purity Ta targets** contain .gtoreq.1 of Ag, Au and Cu 0.001-20 ppm. The targets can create stable plasma for extended time to form TaN barrier layers for Cu interconnections.
IT **7440-25-7**, Tantalum, processes
(**high-purity Ta sputtering targets** for forming TaN barrier layers for Cu interconnections)
RN 7440-25-7 HCA
CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

IC ICM C23C014-34
ICS C22C027-02; H01L021-203; H01L021-285
CC 76-3 (Electric Phenomena)
ST **sputtering** target tantalum nitride barrier layer

IT Diffusion barrier
Interconnections (electric)
Sputtering targets
(**high-purity Ta sputtering targets** for forming TaN barrier layers for Cu interconnections)

IT Semiconductor device fabrication
(**high-purity Ta sputtering targets** for forming TaN barrier layers for Cu interconnections in)

IT 12033-62-4P, Tantalum nitride
(**high-purity Ta sputtering targets** for forming TaN barrier layers for Cu interconnections)

IT **7440-25-7**, Tantalum, processes
(**high-purity Ta sputtering targets** for forming TaN barrier layers for Cu interconnections)

L52 ANSWER 5 OF 43 HCA COPYRIGHT 2002 ACS

136:187332 The annealing behavior of oligocrystalline tantalum deformed by cold swaging. Hupalo, M. F.; Sandim, H. R. Z. (Department of Materials Engineering, DEMAR/FAENQUIL, Lorena, SP, 12600-000, Brazil). Materials Science & Engineering, A: Structural Materials: Properties, Microstructure and Processing, A318(1-2), 216-223 (English) 2001. CODEN: MSAPE3. ISSN: 0921-5093. Publisher: Elsevier Science S.A..

AB The annealing behavior of coarse-grained tantalum deformed at large strains (.epsilon.>1) is strongly dependent on deformation microstructure. In this regard, a **high-purity** coarse-grained double **electron-beam melted** tantalum ingot was deformed to a true strain of 6.4 by cold swaging and annealed between 400 and 1100.degree.C. The annealing behavior was investigated in specimens deformed at three true strains: 1.3, 2.8, and 5.0 using light optical microscopy, SEM in the backscattered mode, and microhardness testing. Results show that **recrystn.** kinetics varies noticeably from grain to grain. Even after annealing at 1100.degree.C for 1 h, the microstructure of tantalum deformed to a true strain of 5.0 predominantly consists of alternating bands of **recrystd. grains** with distinct **size** distributions and a few elongated areas softened by recovery indicating pronounced orientation effects.

IT **7440-25-7**, Tantalum, processes
(annealing and **recrystn.** of oligocryst. tantalum deformed by cold swaging)

RN 7440-25-7 HCA

CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

CC 56-5 (Nonferrous Metals and Alloys)
ST tantalum cold swaging annealing **recrystn**
IT Annealing
Recrystallization
(annealing and **recrystn**. of oligocryst. tantalum deformed by cold swaging)
IT Forging
(cold swaging; annealing and **recrystn**. of oligocryst. tantalum deformed by cold swaging)
IT **7440-25-7**, Tantalum, processes
(annealing and **recrystn**. of oligocryst. tantalum deformed by cold swaging)

L52 ANSWER 6 OF 43 HCA COPYRIGHT 2002 ACS
134:74875 **Sputtering** targets manufactured from refractory metal powder pretreated by plasma for purity. Han, Gang; Murata, Hideo; Nakamura, Hideki (Hitachi Metals, Ltd., Japan). Eur. Pat. Appl. EP 1066899 A2 20010110, 13 pp. DESIGNATED STATES: R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC, PT, IE, SI, LT, LV, FI, RO. (English). CODEN: EPXXDW. APPLICATION: EP 2000-114459 20000705. PRIORITY: JP 1999-192994 ~~19990707.~~
AB Refractory **metal** powders (esp. **Ta** or Ru) are pretreated with thermal plasma contg. H2 gas, resulting in a spheroidized particle shape and **high purity**, and suitable for manuf. of sintered targets for **sputtering**. The plasma-treated Ta or Ru powder has the purity .gtoreq.99 .999% with residual O .ltoreq.100 ppm, and ~~can be sintered~~ to .gtoreq.99% of theor. d. by hot-isostatic pressing. The sintered targets are suitable for **sputtering** of the metal films on intergrated elec. circuits. The tech. Ta powder was pretreated by the plasma based on flowing Ar-8% H2 gas mixt., and the purified powder was packed in a metal-foil capsule and sintered to 99.8% of theor. d. by hot-isostatic pressing for 1 g at 1350.degree. and 155 MPa, vs. 96.3% for the untreated powder of 99.98% purity.
IT **7440-25-7P**, Tantalum, preparation
(powder, for **sputtering** targets; refractory metal powder purified by plasma for sintered **sputtering** targets)
RN 7440-25-7 HCA
CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

IC ICM B22F001-00
ICS C23C014-34
CC 56-6 (Nonferrous Metals and Alloys)
Section cross-reference(s): 76
ST tantalum powder thermal plasma purifn sintering; refractory metal purifn sintered target **sputtering**; elec circuit **sputtering** refractory metal target
IT **Sputtering** targets

(metal powder for sintered; refractory metal powder purified by plasma for sintered **sputtering** targets)

IT Refractory metals
(powder, purifn. of; refractory metal powder purified by plasma for sintered **sputtering** targets)

IT Plasma
(purifn. in, of metal powder; refractory metal powder purified by plasma for sintered **sputtering** targets)

IT Integrated circuits
(**sputtering** on; refractory metal powder purified by plasma for sintered **sputtering** targets)

IT 1333-74-0, Hydrogen, uses 7440-37-1, Argon, uses
(plasma with; refractory metal powder purified by plasma for sintered **sputtering** targets)

IT 7440-18-8P, Ruthenium, preparation **7440-25-7P**, Tantalum, preparation
(powder, for **sputtering** targets; refractory metal powder purified by plasma for sintered **sputtering** targets)

L52 ANSWER 7 OF 43 HCA COPYRIGHT 2002 ACS

133:20940 Grain subdivision and **recrystallization** in oligocrystalline tantalum during cold swaging and subsequent annealing. Sandim, Hugo R. Z.; Padilha, Angelo F.; Randle, Valerie; Blum, Wolfgang (Institut fur Werkstoffwissenschaften, Universitat Erlangen-Nurnberg, Erlangen, D-91058, Germany). International Journal of Refractory Metals & Hard Materials, Volume Date 1999, 17(6), 431-435 (English) 2000. CODEN: IRMME3. ISSN: 0263-4368. Publisher: Elsevier Science Ltd..

AB A coarse-grained ingot of **high-purity** tantalum was deformed by swaging at room temp. to a strain of 1.28. During annealing at 900.degree.C for 30 min two neighboring grains were obsd. to behave quite differently. Electron backscattering diffraction (EBSD) results show noticeable differences in terms of the misorientations developed in both grains. The grain developing larger misorientations **recrystd**. much more readily than the other. The result is interpreted in terms of the differences in grain subdivision into strongly misoriented regions.

IT **7440-25-7**, Tantalum, processes
(grain subdivision and **recrystn**. in oligocryst. tantalum during cold swaging and subsequent annealing)

RN 7440-25-7 HCA

CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

CC 56-8 (Nonferrous Metals and Alloys)

ST tantalum **recrystn** grain division swaging annealing

IT Annealing
Grain size
Texture (metallographic)

(**grain** subdivision and **recrystn**. in
oligocryst. tantalum during cold swaging and subsequent
annealing)
IT Forging
(swaging; grain subdivision and **recrystn**. in
oligocryst. tantalum during cold swaging and subsequent
annealing)
IT **7440-25-7**, Tantalum, processes
(grain subdivision and **recrystn**. in oligocryst.
tantalum during cold swaging and subsequent annealing)

L52 ANSWER 8 OF 43 HCA COPYRIGHT 2002 ACS
132:355531 Improved tantalum-containing barrier layers for copper lines
and contacts using high-purity targets for **sputtering**.
Sun, Binxi; Chiang, Tony; Pavate, Vikram; Ding, Peijun; Chin, Barry;
Sundarrajan, Arvind; Hong, Ilyoung Richard (Applied Materials, Inc.,
USA). PCT Int. Appl. WO 2000029636 A2 20000525, 21 pp. DESIGNATED
STATES: W: DE, GB, JP, KR. (English). CODEN: PIXXD2.
APPLICATION: WO 1999-US26290 19991105. PRIORITY: US 1998-191078
19981112.
AB Improved tantalum-contg. barrier layers for copper lines and
contacts of semiconductor devices are obtained by **sputter**
-depositing tantalum and/or tantalum nitride from targets having a
metallic contaminant content below about 30 ppm, i.e., a niobium
content below about 50 ppm , preferably below 10 ppm, a molybdenum
content below about 10 ppm, a gold content below about 15 ppm, and a
tungsten content below about 10 ppm.
IC ICM C23C014-34
ICS C23C014-16; H01L021-283
CC 76-3 (Electric Phenomena)
IT Electric contacts
(copper; tantalum barrier layers **sputter**-deposited from
high-purity tantalum targets
for)
IT **Sputtering**
(of tantalum barrier layers for copper lines and contacts using
high-purity tantalum targets
)
IT Capacitors
(tantalum barrier layers **sputter**-deposited from
high-purity tantalum targets
for copper contacts of)
IT Semiconductor devices
(tantalum barrier layers **sputter**-deposited from
high-purity tantalum targets
for copper lines and contacts of)
IT 7440-25-7, Tantalum, uses
(barrier layers for copper lines and contacts using **high**
-purity tantalum targets for
sputtering)
IT 12033-62-4, Tantalum nitride
(barrier layers for copper lines and contacts using high-purity

targets for **sputtering**)
IT 7440-50-8, Copper, uses
(improved tantalum barrier layers for copper lines and contacts using **high-purity tantalum targets** for **sputtering**)

L52 ANSWER 9 OF 43 HCA COPYRIGHT 2002 ACS
132:39094 **High-purity** tantalum strip manufactured with uniform microstructure and texture for **sputtering** targets. Shah, Ritesh P.; Segal, Vladimir (Johnson Matthey Electronics, Inc., USA). PCT Int. Appl. WO 9966100 A1 19991223, 15 pp. DESIGNATED STATES: W: CN, DE, GB, JP, KR, SE, SG; RW: AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE. (English). CODEN: PIXXD2. APPLICATION: WO 1998-US18676 19980908. PRIORITY: US 1998-98760 19980617.
AB The Ta billet of .gtoreq.**99.95%** purity is processed by frictionless forging to manuf. a **sputtering** target having fine-grained uniform microstructure and cubic crystallog. texture. The Ta billet is preferably forged by cold upsetting in a press lined with polymer-film lubricant, processed by rolling in different directions, and then is finished by **recrystn**. annealing.
IT **7440-25-7, Tantalum**, uses
(**sputtering targets**; **tantalum** strip with uniform microstructure and texture for **sputtering** targets)
RN 7440-25-7 HCA
CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

IC ICM C23C014-34
ICS C22C027-02; B21C001-00; B32B015-01
CC 56-11 (Nonferrous Metals and Alloys)
Section cross-reference(s): 51
ST **tantalum sputtering target** manuf billet forging; polymer film lubricant tantalum billet forging
IT **Recrystallization**
(annealing; tantalum strip with uniform microstructure and texture annealed for **sputtering** targets)
IT Forging
(frictionless; tantalum strip with uniform microstructure and texture forged for **sputtering** targets)
IT Lubricants
(polymer film; tantalum billet forged with polymer film lubricant for uniform microstructure and texture in annealed **sputtering** targets)
IT **Sputtering targets**
(**tantalum** strip with uniform microstructure and texture for **sputtering** targets)
IT **7440-25-7, Tantalum**, uses

(**sputtering targets**; **tantalum** strip
with uniform microstructure and texture for **sputtering**
targets)

L52 ANSWER 10 OF 43 HCA COPYRIGHT 2002 ACS

132:14077 Purification of tantalum powder for manufacture of **sputtering** targets by ingot casting and machining. Rosenberg, Harry; Ozturk, Bahri; Wang, Guangxin; Larue, Wesley (Alta Group, Inc., USA). PCT Int. Appl. WO 9961670 A1 19991202, 23 pp. DESIGNATED STATES: W: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM; RW: AT, BE, BF, BJ, CF, CG, CH, CI, CM, CY, DE, DK, ES, FI, FR, GA, GB, GR, IE, IT, LU, MC, ML, MR, NE, NL, PT, SE, SN, TD, TG. (English). CODEN: PIXXD2. APPLICATION: WO 1999-US11691 19990526. PRIORITY: US 1998-86868 19980527; US 1999-316777 19990521

AB The Ta powder is manufd. from purified **K2TaF7** feed by redn. with Na, and the resulting Ta sponge is purified by reaction with I2 vapor in a container app. lined with Mo, W, or the Mo-W alloy. The com. **K2TaF7** is preferably purified to remove the Nb assocd. with Ta in ores. The process can be modified for recovery of the Ta from scrap. The **high-purity** Ta sponge or powder is **melted** with **electron beam** and cast to obtain the Ta ingot suitable for machining of the **sputtering** targets. The **high-purity** Ta can be prepd. with <20 ppm of Nb, Mo, and W, and is suitable for **sputtered** films in the manuf. of semiconductor circuits or elec.-film capacitors.

IT **7440-25-7P**, Tantalum, preparation
(for **sputtering**; purifn. of tantalum powder for manuf. of **sputtering** targets by casting and machining)

RN 7440-25-7 HCA

CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

IC ICM C22B034-24
ICS C23C014-34

CC 54-3 (Extractive Metallurgy)
Section cross-reference(s): 76

ST tantalum sponge powder purifn iodine vapor; **electron beam melted tantalum target sputtering**; elec circuit **tantalum sputtering target** manuf

IT Capacitors
(film, **sputtered** tantalum for; purifn. of tantalum powder for manuf. of **sputtering** targets by casting and machining)

IT **Electron beams**
(**melting** with, of tantalum; purifn. of tantalum powder for manuf. of **sputtering** targets by casting and machining)

IT Integrated circuits
Sputtering
(tantalum for; purifn. of tantalum powder for manuf. of **sputtering** targets by casting and machining)

IT **7440-25-7P**, Tantalum, preparation
(for **sputtering**; purifn. of tantalum powder for manuf. of **sputtering** targets by casting and machining)

IT 7439-98-7, Molybdenum, processes 7440-03-1, Niobium, processes 7440-33-7, Tungsten, processes
(in tantalum purifn.; purifn. of tantalum powder for manuf. of **sputtering** targets by casting and machining)

IT 16924-00-8P, **Potassium fluorotantalate** (**K2TaF7**)
(redn. of, for tantalum powder; purifn. of tantalum powder for manuf. of **sputtering** targets by casting and machining)

IT 7440-23-5, Sodium, processes
(redn. with; purifn. of tantalum powder for manuf. of **sputtering** targets by casting and machining)

IT 7553-56-2, Iodine, processes
(vapor, tantalum purifn. with; purifn. of tantalum powder for manuf. of **sputtering** targets by casting and machining)

L52 ANSWER 11 OF 43 HCA COPYRIGHT 2002 ACS

131:66659 **Sputtering** targets and copper wirings. Sato, Michio; Kousaka, Yasuo (Toshiba Corp., Japan). Jpn. Kokai Tokkyo Koho JP 11176769 A2 19990702 Heisei, 7 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1997-345394 19971215.

AB **Sputtering** targets comprising Cu of purity .gtoreq. **99.999%** and having controlled contents of O .ltoreq.10, S .ltoreq.1, and Fe .ltoreq.1 ppm are claimed. The targets may optionally contain 0.5-250 ppm Ti, Zr, V, Cr, Nb, Ta, Y, La, and/or Sc. Cu wirings satisfying the above compns., that are formed by **sputtering**, are also claimed. The wirings show high fluidity during **sputtering** and semiconductor devices with dense wirings are manufd.

IT **7440-25-7**, Tantalum, processes
(microalloying element; **high-purity** Cu **sputtering** targets with controlled O, S, and Fe contents for formation of semiconductor wirings)

RN 7440-25-7 HCA

CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

IC ICM H01L021-285
ICS C22C009-00; C23C014-34

CC 76-3 (Electric Phenomena)

Section cross-reference(s): 56, 75

ST copper **high purity sputtering** target;
oxygen controlled copper **sputtering** target; sulfur
controlled copper **sputtering** target; iron controlled
copper **sputtering** target; wiring copper **sputtering**
semiconductor device

IT Electric conductors
Sputtering targets
(**high-purity** Cu **sputtering** targets
with controlled O, S, and Fe contents for formation of
semiconductor wirings)

IT Films
(**sputter**-deposited; **high-purity** Cu
sputtering targets with controlled O, S, and Fe contents
for formation of semiconductor wirings)

IT Semiconductor devices
(wirings; **high-purity** Cu **sputtering**
targets with controlled O, S, and Fe contents for formation of
semiconductor wirings)

IT 7440-22-4, Silver, occurrence
(content-controlled; **high-purity** Cu
sputtering targets with controlled O, S, and Fe contents
for formation of semiconductor wirings)

IT 7440-50-8, Copper, processes
(**high-purity** Cu **sputtering** targets
with controlled O, S, and Fe contents for formation of
semiconductor wirings)

IT 7439-89-6, Iron, occurrence 7704-34-9, Sulfur, occurrence
7782-44-7, Oxygen, occurrence
(**high-purity** Cu **sputtering** targets
with controlled O, S, and Fe contents for formation of
semiconductor wirings)

IT 7439-91-0, Lanthanum, processes 7440-03-1, Niobium, processes
7440-20-2, Scandium, processes **7440-25-7**, Tantalum,
processes 7440-32-6, Titanium, processes 7440-47-3, Chromium,
processes 7440-62-2, Vanadium, processes 7440-65-5, Yttrium,
processes 7440-67-7, Zirconium, processes
(microalloying element; **high-purity** Cu
sputtering targets with controlled O, S, and Fe contents
for formation of semiconductor wirings)

L52 ANSWER 12 OF 43 HCA COPYRIGHT 2002 ACS

127:143187 Improvement in characteristics of **high
purity** tantalum by doping and embrittlement mechanism of
tantalum wire used in tantalum capacitors. Izumi, Tomoo (Res. Dev.,
Showa Cabot Supermetals K. K., Fukushima, 969-34, Japan). Denkai
Chikudenki Hyoron, 48(1), 24-51 (English) 1997. CODEN: DCHYAK.
ISSN: 0286-5629. Publisher: Denkai Chikudenki Kenkyukai.

AB A review with 5 refs. The characteristics of Ta as a material for
high temp. use are explained. To solve the problems of Ta
(embrittlement etc.), a Ta material which contains a Ta-grain-growth
controlling agent and whose grains grow slower at high temp. than

the existing pure Ta, i.e., Y2O3-doped Ta, was produced. The Y2O3-doped Ta is reviewed. The technol. which permits the uniform dispersal of Y2O3 in Ta by EBM (**electron beam melting**), a new method for analyzing Y in Ta, etc. are reviewed. Y2O3 added by EBM had the effect of controlling growth in Ta grains during annealing at a temp. over 1500.degree. even if its concn. is <1 ppm. The embrittlement mechanism occurring in a Ta lead wire of a Ta capacitor was analyzed, observing the **grain size** of the Ta lead wire, and observing the surfaces of the Ta lead wire where the breakage occurred. Some discoveries are shown, showing the effect of O2 on the hardness of Ta.

IT **7440-25-7**, Tantalum, properties
(improvement in characteristics of **high purity** tantalum by doping and embrittlement mechanism of tantalum wire used in tantalum capacitors)

RN 7440-25-7 HCA

CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

CC 76-0 (Electric Phenomena)
Section cross-reference(s): 56

IT Doping
Embrittlement
(improvement in characteristics of **high purity** tantalum by doping and embrittlement mechanism of tantalum wire used in tantalum capacitors)

IT Capacitors
Wires
(tantalum; improvement in characteristics of **high purity** tantalum by doping and embrittlement mechanism of tantalum wire used in tantalum capacitors)

IT 1314-36-9, Yttrium oxide (Y2O3), uses 7440-65-5, Yttrium, uses 7782-44-7, Oxygen, uses
(dopant; improvement in characteristics of **high purity** tantalum by doping and embrittlement mechanism of tantalum wire used in tantalum capacitors)

IT **7440-25-7**, Tantalum, properties
(improvement in characteristics of **high purity** tantalum by doping and embrittlement mechanism of tantalum wire used in tantalum capacitors)

L52 ANSWER 13 OF 43 HCA COPYRIGHT 2002 ACS

127:72588 Improved RF plasma jet generation of singlet delta oxygen. Schmiedberger, Josef; Takahashi, Sanyo; Fujii, Hiroo (Department of Gas Lasers, Institute of Physics, Academy of Sciences of the Czech Republic, Prague, 180 40/8, Czech Rep.). Proceedings of SPIE-The International Society for Optical Engineering, 3092(XI International Symposium on Gas Flow and Chemical Lasers and High-Power Laser Conference, 1996), 694-697 (English) 1997. CODEN: PSISDG. ISSN:

0277-786X. Publisher: SPIE-The International Society for Optical Engineering.

AB RF O plasma jets were studied exptl. as an alternative source of mol. singlet delta O for an O-I laser. The relative yield of singlet delta O was measured under a wide variety of exptl. conditions. The RF frequency range was 27.2-**99.9** MHz and the RF power was up to 200 W. The O output pressure was 0.05-0.40 torr and the O flow rate was 195-1000 sccm. **High purity** O or its mixts. with Ar, N2, NO and Hg at the pumping velocity of 250 m3/h were used. The plasma jet was produced in nozzles, having the inner diam. of 1-6 mm and the length of 1-16 mm. The nozzle materials Al, Ti, Ta and W gave significantly better results than Pt and Ni. The dependence of singlet delta O prodn. on the radiofrequency was increasing monotonously. Other dependencies were not monotonous and exhibited an optimum. The continuous-wave mode of operation gave usually better results than a pulsed mode. The most effective admixt. was N2, which gave the highest enhancement. This resulted in the relative yield of singlet delta O exceeding 15%.

IT **7440-25-7**, Tantalum, uses
(improved RF plasma jet generation of singlet delta oxygen)

RN 7440-25-7 HCA

CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

CC 73-10 (Optical, Electron, and Mass Spectroscopy and Other Related Properties)

IT **Sputtering** cathodes
(hollow; improved RF plasma jet generation of singlet delta oxygen)

IT 7429-90-5, Aluminum, uses 7439-97-6, Mercury, uses 7440-02-0, Nickel, uses 7440-06-4, Platinum, uses **7440-25-7**, Tantalum, uses 7440-32-6, Titanium, uses 7440-33-7, Tungsten, uses 7440-37-1, Argon, uses 7553-56-2, Iodine, uses 7727-37-9, Nitrogen, uses 10102-43-9, Nitric oxide, uses
(improved RF plasma jet generation of singlet delta oxygen)

L52 ANSWER 14 OF 43 HCA COPYRIGHT 2002 ACS

127:68795 The industrial application of pyrometallurgical, chlorination and hydrometallurgy for producing tantalum compounds. Eckert, Joachim (H. C. Starck GmbH and Co. KG, Goslar, D-38642, Germany). Tantalum, Proceedings of a Symposium held at the 125th TMS Annual Meeting and Exhibition, Anaheim, Calif., Feb. 5-8, 1996, 55-61. Editor(s): Chen, Edward S. Minerals, Metals & Materials Society: Warrendale, Pa. (English) 1996. CODEN: 64PJA2.

AB A review with no refs. The modern industrial prodn. of tantalum compds., like potassium heptafluorotantalate (**K2TaF7**), is not restricted to the wet chem. processing of tantalum bearing ores, but includes the pyrometallurgical upgrading of tantalum-contg. slags and residues as well as the chorination of ferroalloys and

ores. Considerable progress in producing tantalum compds. by hydrometallurgy was made in the early seventies. Since then, this technique has been continuously modified and improved. Today, tantalum compds. of **high purity** are manufd. in large quantities for use as starting materials for the prodn. of **tantalum metal**. Recent process improvements now make it possible to utilize raw materials with extremely unfavorable Ta/Nb ratios, thus assuring a stable supply of tantalum for the foreseeable future.

IT **7440-25-7P**, Tantalum, preparation
(pyrometallurgy, chlorination and hydrometallurgy)

RN 7440-25-7 HCA

CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

CC 54-0 (Extractive Metallurgy)
Section cross-reference(s): 49

IT **7440-25-7P**, Tantalum, preparation
(pyrometallurgy, chlorination and hydrometallurgy)

L52 ANSWER 15 OF 43 HCA COPYRIGHT 2002 ACS

126:97558 Effect of composition on electrical properties of SBT thin films deposited by reactive **sputtering**. Park, Sang-Shik; Yang, Cheol-Hoon; Chae, Su-Jin; Yoon, Soon-Gil; Kim, Ho-Gi (Dept. Materials Engineering, Chungnam National University, Taejon, 305-764, S. Korea). Han'guk Chaelyo Hakhoechi, 6(9), 931-936 (Korean) 1996. CODEN: HCHAEU. ISSN: 1225-0562. Publisher: Materials Research Society of Korea.

AB $SrBi_2Ta_2O_9$ (SBT) thin films for nonvolatile memory application were deposited onto $Pt/Ti/SiO_2/Si$ substrate by reactive **sputtering** technique using Sr, Bi, **Ta metal targets** of **high purity**. To evaluate the effect of compn., the elec. properties of C-F (capacitance-frequency), P-E (polarization-elec. field) and I-V (current-voltage) were studied according to applied power to Bi target and annealing. With increasing the Bi amt., the (105) diffraction peak of SBT film indicating the formation of a bismuth layered structure was increased. After annealing at 700.degree., Bi and Sr were vaporized significantly and the microstructure of films was very porous, therefore the leakage c.d. of annealed film was increased. Annealed films showed almost stoichiometric compn. and ferroelec. property with Pr of 4.5 .mu.C/cm2.

CC 76-3 (Electric Phenomena)

ST elec property strontium bismuth tantalum oxide; reactive **sputtering** film deposition; ferroelec strontium bismuth tantalum oxide film

IT Electric properties
Ferroelectricity
Reactive **sputtering**
(effect of compn. on elec. properties of SBT thin films deposited

by reactive **sputtering**)
IT 50811-07-9, Bismuth strontium tantalum oxide (Bi2SrTa2O9)
(effect of compn. on elec. properties of SBT thin films deposited by reactive **sputtering**)

L52 ANSWER 16 OF 43 HCA COPYRIGHT 2002 ACS
122:112045 Manufacturing of ultrafine-grained and **high-purity** Ta powders by phase transformation. Li, Jinyao; Zhou, Guizhi; Chen, Shaoyi (Central South Univ. Technology, Changsha, 410083, Peop. Rep. China). Xiyou Jinshu Cailiao Yu Gongcheng, 23(4), 61-5 (Chinese) 1994. CODEN: XJCGEA. ISSN: 1002-185X. Publisher: Xiyou Jinshu Cailiao Yu Gongcheng Zazhishe.
AB A method of manufg. ultra-fine and **high-purity** Ta powder was investigated by using phase transformation. A reversible phase transformation occurs at 200-250.degree. for **K2TaF7**. After phase transformation, the size of **K2TaF7** crystal can be reduced from 1351.8 .mu.m to 70.8 .mu.m, and the sp. surface area is increased greatly.
IT **7440-25-7P**, Tantalum, preparation
(manufg. of **ultrafine**-grained **high-purity** tantalum powders by phase transformation)
RN 7440-25-7 HCA
CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

CC 56-8 (Nonferrous Metals and Alloys)
Section cross-reference(s): 54
IT **7440-25-7P**, Tantalum, preparation
(manufg. of **ultrafine**-grained **high-purity** tantalum powders by phase transformation)

L52 ANSWER 17 OF 43 HCA COPYRIGHT 2002 ACS
117:155565 Influence of transverse rolling on the microstructural and texture development in pure tantalum. Clark, J. B.; Garrett, R. K.; Jungling, T. L.; Asfahani, R. I. (Nav. Surf. Warf. Cent., Silver Spring, MD, 20903-5000, USA). Metallurgical Transactions A: Physical Metallurgy and Materials Science, 23A(8), 2183-91 (English) 1992. CODEN: MTTABN. ISSN: 0360-2133.
AB The influence of transverse rolling passes on the **recrystn**. texture was investigated in an effort to strengthen the {111}.ltbbrac.uvw.rtbbrac. type components and reduce the intensity of the {100}.ltbbrac.0vw.rtbbrac. components, improve the uniformity of the microstructure, and refine the **grain size** in **high-purity** tantalum plate. Tantalum, from three different ingot breakdown processes, received an addnl. 80% redn. in the transverse direction (perpendicular to the ingot centerline) in the processing schedule prior to final annealing. The influence was studied of the addnl. transverse rolling passes on the development of texture in the as-rolled tantalum and also in rolled plus annealed tantalum. After annealing, the tantalum plates

had significantly strengthened {111}.ltbbrac.uvw.rtbbrac. crystallog. orientations, not only for the side forged process, but also for the upset and side forged tantalum. For tantalum processed by extrusion, the transverse rolling did not improve the final **recrystd.** texture.

IT **7440-25-7**, Tantalum, properties
(**recrystn.** texture and microstructure of, transverse rolling effect on)

RN 7440-25-7 HCA

CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

CC 56-8 (Nonferrous Metals and Alloys)

ST tantalum **recrystn** texture transverse rolling

IT Texture, metallographic
(of tantalum, transverse rolling effect on **recrystn.**)

IT **Recrystallization**
(of tantalum, transverse rolling effect on texture and microstructure in)

IT Metalworking
(rolling, transverse, of tantalum, **recrystn.** texture and microstructure in relation to)

IT **7440-25-7**, Tantalum, properties
(**recrystn.** texture and microstructure of, transverse rolling effect on)

L52 ANSWER 18 OF 43 HCA COPYRIGHT 2002 ACS

117:60918 Aluminum foil containing beryllium, phosphorus, and/or tantalum for electrolytic capacitor. Isoyama, Eizo; Sakaguchi, Masashi; Fujihira, Tadao; Umetsu, Shozo (Showa Aluminum K. K., Japan). Jpn. Kokai Tokkyo Koho JP 04062824 A2 19920227 Heisei, 4 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1990-167090 19900625.

AB The title foil comprises .gtoreq.**99.9%**-pure Al contg. Be, P, and/or Ta at total amt. 0.2-20 ppm, in which the mixt. concn. of the surface layer of .ltoreq.0.1 **.mu.m** thickness from the top is 1.5-500 times higher than the inner concn. Thus, a **99.9%** Al contg. 0.002% Si and 0.002% Fe, which was assocd. with Be, was soln. cast, hot-rolled, cold-rolled, rolled, annealed, and rolled to form a foil then Be was applied onto the surface by ion **sputtering** and annealed to give the title foil useful for an anode of a medium-to-high capacitor with large capacitance.

IT **7440-25-7**, Tantalum, uses
(aluminum foil contg., for electrolytic capacitor, controlled distribution in)

RN 7440-25-7 HCA

CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

IC ICM H01G009-04
ICS C22C021-00; C25F003-04; H01G009-04
CC 76-10 (Electric Phenomena)
Section cross-reference(s): 56
ST electrolytic capacitor aluminum foil; beryllium ion **sputtering** surface aluminum; phosphorus tantalum aluminum foil capacitor; anode aluminum capacitor **high purity**
IT **7440-25-7**, Tantalum, uses 7440-41-7, Beryllium, uses 7723-14-0, Phosphorus, uses
(aluminum foil contg., for electrolytic capacitor, controlled distribution in)

L52 ANSWER 19 OF 43 HCA COPYRIGHT 2002 ACS
116:88307 Preparation of tantalum powder by reduction of fluorotantalate with sodium. Gruner, Matthias; Ibold, Heiko; Naumann, Ulrich (VEB Mansfeld-Kombinat "Wilhelm Pieck", Germany). Ger. (East) DD 291580 A5 19910704, 3 pp. (German). CODEN: GEXXA8. APPLICATION: DD 1990-337232 19900122.
AB After the redn. of **K2TaF7** with Na, the resulting cake is powd. and the powder is heated at 0.013-1.33 Pa and 800-1050.degree. with intermittent vibration to promote impurity salt removal by volatilization. The dry procedure eliminates rinsing solns. as well as permits the redn. with excess Na to increase the Ta yield without contamination. The **high-purity** Ta powder is useful for manuf. of electrolytic capacitors. Thus, the cake from Na redn. of **K2TaF7** (contg. Ta 21.3, NaF 37, NaCl 22, KCl 18, and Na 1.7%) was heated in a retort at 0.27 Pa and 950.degree. with intermittent vibration for volatilizing and condensation of salts. The resulting Ta powder contained 31 Na and 40 ppm K.
IT **7440-25-7P**, Tantalum, preparation
(powder, prepn. and purifn. of, by redn. of fluorotantalate with sodium)
RN 7440-25-7 HCA
CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

IC ICM C22B034-24
ICS B22F009-20
CC 54-3 (Extractive Metallurgy)
Section cross-reference(s): 76
IT **7440-25-7P**, Tantalum, preparation
(powder, prepn. and purifn. of, by redn. of fluorotantalate with sodium)
IT 16924-00-8, Potassium tantalum fluoride (**K2TaF7**)
(redn. of, tantalum powder by, for manuf. of electrolytic

capacitors)

L52 ANSWER 20 OF 43 HCA COPYRIGHT 2002 ACS
116:73868 Some properties of RF **sputtered** aluminum sesquioxide-titanium sesquioxide composite thin films. Nomura, Koji; Ogawa, Hisahito (Cent. Res. Lab., Matsushita Electr. Ind. Co., Ltd., Moriguchi, 570, Japan). Journal of the Electrochemical Society, 138(12), 3701-5 (English) 1991. CODEN: JESOAN. ISSN: 0013-4651.

AB Al2O3-Ta2O5 composite dielec. thin films were prepd. by RF plasma **sputtering** under various prepn. conditions. Secondary ion mass spectroscopy and XPS were used to investigate the impurities and the oxygen vacancies in the films. The main impurity of the film was Na, but the sodium can be reduced by the use of **high purity** (5N) Al-**Ta metal target**. Oxygen vacancies were mainly related to Ta atoms and were dependent on the deposition rate of the films. Films **sputtered** at around 50 .ANG./min were found to be relatively good for thin film devices, i.e., they have a high dielec. const. (.epsilon.r:.apprx.9), a low leakage current (.apprx.30 mA/F, at 10 V), and fewer oxygen vacancies. The prepn., details of the structure, and some elec. properties of the Al2O3-Ta2O5 composite dielec. thin films are described.

CC 76-9 (Electric Phenomena)

ST aluminum tantalum dielec film **sputtering**; sodium impurity aluminum tantalum dielec

IT **Sputtering**
(of alumina-tantalum oxide dielec. films)

L52 ANSWER 21 OF 43 HCA COPYRIGHT 2002 ACS
116:64640 Influence of initial ingot breakdown on the microstructural and textural development of **high-purity** tantalum. Clark, J. B.; Garrett, R. K., Jr.; Jungling, T. L.; Asfahani, R. I. (Nav. Surf. Warf. Cent., White Oak, MD, 20903-5000, USA). Metallurgical Transactions A: Physical Metallurgy and Materials Science, 22A(12), 2959-68 (English) 1991. CODEN: MTTABN. ISSN: 0360-2133.

AB The influence of initial ingot breakdown on the rolling and **recrystn**. textures of **high-purity** Ta plate was investigated using optical microscopy and x-ray diffraction. The 4 ingot breakdown processes investigated include 2 com. processes and 2 processes new to Ta. Correlations among the 4 ingot breakdown processes, the **recrystd**. **grain size**, and the final texture were established. The plate from the completely upset-forged ingot had the strongest {111} <110> and {111} <112> texture components, while the plate from the side-forged ingot **recrystd**. with a mixed texture. Increased upset forging along the ingot centerline strengthened the {111} <uvw> orientations and weakened the {100} <uvw> orientations in the annealed plates. **Recrystn**. studies were conducted on the rolled plates to develop an optimum texture with {111} <110> and {111} <112> components in the final **recrystd**. plate.

IT 7440-25-7, Tantalum, properties
(texture of, ingot breakdown effect on)
RN 7440-25-7 HCA
CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

CC 56-8 (Nonferrous Metals and Alloys)
ST tantalum ingot breakdown microstructure texture; rolling tantalum texture ingot breakdown; **recrystn** tantalum texture ingot breakdown
IT Texture, metallographic
(of tantalum, ingot breakdown effect on rolling and **recrystn**.)
IT Cast **metals** and alloys
(**tantalum** ingots, breakdown of, texture in relation to)
IT **Recrystallization**
(texture, of tantalum, ingot breakdown effect on)
IT **7440-25-7**, Tantalum, properties
(texture of, ingot breakdown effect on)

L52 ANSWER 22 OF 43 HCA COPYRIGHT 2002 ACS
114:148337 AES observations of refractory metal surfaces after a short time of indoor exposure. Fukushima, Toshiro; Itomura, Shohsuke; Oshikawa, Wataru; Yoshihara, Kazuhiro; Fujiwara, Jun (Coll. Eng., Univ. Ryukyus, Nishihara, 903-01, Japan). Proceedings - Electrochemical Society, 91-2(Proc. Int. Symp. Corros. Electron. Mater. Devices, 1st, 1990), 303-18 (English) 1991. CODEN: PESODO. ISSN: 0161-6374.
AB Refractory metals Ti, Zr, Hf, V, Nb, Ta, Cr, Mo and W, each having a purity of **99.99%**, were exposed in a clean room for a few seconds and in an ordinary office in a subtropical region for 10 mo after cleaning of their surfaces by Ar ion **sputtering**. The AES anal. indicated that C and O were in the metal surface layers. These C and O concns. increased with increasing exposure time.
IT **7440-25-7**, Tantalum, properties
(surface of **high-purity**, after indoor exposure, carbon and oxygen in, AES anal. of)
RN 7440-25-7 HCA
CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

CC 56-10 (Nonferrous Metals and Alloys)
ST titanium surface oxygen carbon; zirconium surface oxygen carbon; hafnium surface oxygen carbon; vanadium surface oxygen carbon; niobium surface oxygen carbon; tantalum surface oxygen carbon; chromium surface oxygen carbon; tungsten surface oxygen carbon; refractory metal **sputtering** argon ion

IT **Sputtering**
(of refractory metals, by argon ions, AES anal. of carbon and oxygen after indoor exposure in relation to)
IT 7440-44-0, Carbon, analysis 7782-44-7, Oxygen, analysis
(in surface layers of refractory metals, after indoor exposure, AES anal. of, argon ion **sputtering** in relation to)
IT 7440-37-1D, Argon, ions, uses and miscellaneous
(**sputtering** by, of refractory metal surfaces, AES anal. of carbon and oxygen in relation to)
IT 7439-98-7, Molybdenum, properties 7440-03-1, Niobium, properties **7440-25-7**, Tantalum, properties 7440-32-6, Titanium, properties 7440-33-7, Tungsten, properties 7440-47-3, Chromium, properties 7440-58-6, Hafnium, properties 7440-62-2, Vanadium, properties 7440-67-7, Zirconium, properties
(surface of **high-purity**, after indoor exposure, carbon and oxygen in, AES anal. of)

L52 ANSWER 23 OF 43 HCA COPYRIGHT 2002 ACS
110:164196 Leakage-current reduction in thin tantalum pentoxide films for high-density VLSI memories. Hashimoto, Chisato; Oikawa, Hideo; Honma, Nakahachiro (NTT Electr. Commun. Lab., Atsugi, Japan). IEEE Transactions on Electron Devices, 36(1, Pt. 1), 14-18 (English) 1989. CODEN: IETDAI. ISSN: 0018-9383.
AB Key techniques for applying a Ta2O5 film, which has a dielec. const. over 6 times larger than that of SiO2, to megabit-class MOS dynamic RAM's (DRAM's) are presented. A **high-purity** (4N and up) **Ta sputtering target** was developed to obtain high-purity Ta2O5 films. The leakage current in a Ta2O5 film that is deposited by using a clean **sputtering** system, which installs this high-purity target, is far lower than that for film deposited with a conventional target. A previous Ta2O5 drawback, in which its effective dielec. const. decreases as its thickness decreases, is solved by adopting Mo as an electrode material. The leakage current increase caused by using metal as a bottom electrode is suppressed by reducing the electrode asperity. Using 20-.ANG. Mo as the bottom electrode is proposed. MOS DRAM's of up to 16-Mbit capacity can be attained without trench capacitor technol. by using these techniques.
CC 76-3 (Electric Phenomena)

L52 ANSWER 24 OF 43 HCA COPYRIGHT 2002 ACS
109:243162 Multielement ultratrace analysis of molybdenum with high-performance secondary-ion mass spectrometry. Virag, A.; Friedbacher, G.; Grasserbauer, M.; Ortner, H. M.; Wilhartitz, P. (Inst. Anal. Chem., Univ. Technol. Vienna, Vienna, A-1060, Austria). Journal of Materials Research, 3(4), 694-704 (English) 1988. CODEN: JMREEE. ISSN: 0884-2914.
AB **Electron beam melting** has been used to obtain **ultrapure** refractory metals that are gaining importance in metal oxide semiconductor-very large scale integration (MOS-VLSI) processing technol., fusion reactor technol., or as superconducting materials. Although the technol. of

electron beam melting is well
established in the field of prodn. of very clean refractory metals, little is known about the limitations of the method because the impurity level of the final products is frequently below the detection power of common methods for trace anal. Characterization of these materials can be accomplished primarily by in situ methods like neutron activation anal. and mass spectrometric methods [**glow discharge** mass spectrometry (GDMS), secondary ion mass spectrometry (SIMS)]. A suitable SIMS has been developed method for quant. multielement ultratrace bulk anal. of molybdenum. Detection limits ranged from 10-7 g/g down to 10-12 g/g. Addnl. information about the distribution of the trace elements has been accumulated.

IT **7440-25-7**, analysis
(detn. of trace, in molybdenum by high-performance SIMS)

RN 7440-25-7 HCA

CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

CC 79-6 (Inorganic Analytical Chemistry)
Section cross-reference(s): 56

IT 7429-90-5, Aluminum, analysis 7439-89-6, analysis 7439-95-4, analysis 7439-96-5, analysis 7440-02-0, analysis 7440-09-7, analysis 7440-21-3, analysis 7440-23-5, analysis 7440-24-6, analysis **7440-25-7**, analysis 7440-29-1, analysis 7440-31-5, analysis 7440-32-6, analysis 7440-33-7, analysis 7440-36-0, analysis 7440-38-2, analysis 7440-39-3, analysis 7440-42-8, analysis 7440-47-3, analysis 7440-48-4, analysis 7440-50-8, analysis 7440-61-1, analysis 7440-62-2, analysis 7440-65-5, analysis 7440-67-7, analysis 7440-70-2, analysis
(detn. of trace, in molybdenum by high-performance SIMS)

IT 7439-98-7, Molybdenum, analysis
(trace element detn. in **high-purity**, by SIMS)

L52 ANSWER 25 OF 43 HCA COPYRIGHT 2002 ACS

108:178541 Formation of **high-purity** insulating films. Hashimoto, Chisato; Oikawa, Hideo; Honma, Chuhachiro (Nippon Telegraph and Telephone Public Corp., Japan). Jpn. Kokai Tokkyo Koho JP 62259448 A2 19871111 Showa, 7 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1986-85746 19860414.

AB The title method is characterized by purifn. of a refractory metal material and formation of an oxide or nitride film (e.g., of Ta, Nb, Ti, Hf, Zr, or Al) using reactive **sputtering**, thermal oxidn., vacuum deposition, or chem. vapor deposition. **Electron-beam fusion** may be involved in the purifn. The insulating film may contain Na < 0.02, K < 0.02, Cr < 0.02, Fe < 0.05, Ni < 0.05, Mo < 0.2, Nb < 0.2, W 0.3, Zr < 0.2, and U 0.0005 ppm. A Ta2O5 film 640-.ANG. thick was formed on a Si substrate by **sputtering** of a **Ta target** in Ar-O2 and an Al layer was then formed. A 3-layer laminate had a

decreased leak current and was useful for a semiconductor device.

IC ICM H01L021-316
ICS H01L027-04

CC 76-10 (Electric Phenomena)
Section cross-reference(s): 75

ST refractory oxide **high purity** insulator film;
semiconductor device **high purity** insulator film;
nitride refractory **high purity** insulator film

IT Electric insulators and Dielectrics
Semiconductor devices
(refractory oxide and nitride **high-purity** films for)

IT 1313-96-8, Niobium oxide (unspecified) 1314-23-4, Zirconium oxide (ZrO_2), uses and miscellaneous 1314-61-0, Tantalum oxide (Ta_2O_5) 1344-28-1, uses and miscellaneous 12033-62-4, Tantalum nitride (TaN) 12055-23-1, Hafnium oxide (HfO_2) 13463-67-7, uses and miscellaneous 24304-00-5, Aluminum nitride (AlN) 24621-21-4, Niobium nitride (NbN) 25583-20-4, Titanium nitride (TiN) 25658-42-8 25817-87-2
(**high-purity** elec. insulator films from)

L52 ANSWER 26 OF 43 HCA COPYRIGHT 2002 ACS

108:117228 Nitrogen- and carbon-containing aluminum alloy for wiring of semiconductor devices for electromigration prevention. Sawada, Susumu; Kanano, Osamu (Nippon Mining Co., Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 62240738 A2 19871021 Showa, 5 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1986-82186 19860411.

AB The dil. Al alloys for **sputtered** coating in semiconductor device wiring contain .gtoreq.1 of Cu, Co, Mn, Ni, Sn, In, Au, and/or Ag 0.001-0.02, .gtoreq.1 of Ti, Zr, Hf, V, Nb, Ta, Cr, Mo, and/or W 0.002-0.7, N 0.002-0.5, C 0.002-0.5, and optionally Si 0.5-1.5%. The alloys are suitable for wiring of a semiconductor integrated circuit and is effective in preventing electromigration. Thus, a mixt. of master Al-C alloy (**99.95%** purity), Al-N master alloy (**99.95%** purity), Ti, and Cu was melted in a **high-purity** crucible in a furnace, cast, and machined to manuf. a **sputtering** target. A film was formed on an Si substrate by vacuum evapn. of the target, and showed high stability in elec.-current conducting test at c.d. 1 .times. 10fA/cm2 and 175.degree., compared with pure Al, dil. Al-Cu alloy, or dil. Al-Cu-Si alloy.

IT **7440-25-7**, Tantalum, properties
(aluminum alloy contg. carbon and nitrogen and, for film in semiconductor integrated circuit with electromigration prevention)

RN 7440-25-7 HCA

CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

IC ICM C22C021-00

ICS H01L023-48
CC 56-3 (Nonferrous Metals and Alloys)
Section cross-reference(s): 76
IT 7439-96-5, Manganese, properties 7439-98-7, Molybdenum, properties 7440-02-0, Nickel, properties 7440-03-1, Niobium, properties 7440-22-4, Silver, properties **7440-25-7**, Tantalum, properties 7440-31-5, Tin, properties 7440-32-6, Titanium, properties 7440-33-7, Tungsten, properties 7440-47-3, Chromium, properties 7440-48-4, Cobalt, properties 7440-50-8, Copper, properties 7440-57-5, Gold, properties 7440-58-6, Hafnium, properties 7440-62-2, Vanadium, properties 7440-67-7, Zirconium, properties 7440-74-6, Indium, properties
(aluminum alloy contg. carbon and nitrogen and, for film in semiconductor integrated circuit with electromigration prevention)

L52 ANSWER 27 OF 43 HCA COPYRIGHT 2002 ACS
106:42446 Leakage-current reduction in thin tantalum oxide films using **high purity tantalum target**.
Hashimoto, Chisato; Oikawa, Hideo (NTT Atsugi Electr. Commun. Lab., Atsugi, Japan). Ext. Abstr. Conf. Solid State Devices Mater., 17th, 275-8 (English) 1985. CODEN: EACMES.
AB A **high-purity Ta sputtering target** was developed, and a mobile-charge-free **sputtering** system was constructed employing this target in a radio-frequency magnetron **sputtering** app. with an ultraclean **sputtering** chamber. The leakage current in Ta2O5 film deposited by reactive **sputtering** with this clean **sputtering** system is drastically reduced, compared with that using a conventional target. It is low enough for use as a storage capacitor in a ultra-high-d. MOS dynamic RAM.
CC 76-11 (Electric Phenomena)
Section cross-reference(s): 75
ST tantalum oxide **sputter** deposition; leakage current tantalum oxide
IT **Sputtering**
(tantalum pentoxide film deposition by, from **high-purity tantalum target**)
IT Electric insulators and Dielectrics
(coatings, tantalum pentoxide, **sputter**-deposition of, from **high-purity tantalum target**)
IT Electric current
(leakage, of tantalum pentoxide films **sputter**-deposited from **high-purity tantalum target**)
IT 1314-61-0, Tantalum pentoxide
(**sputter**-deposition of films of, from **high-purity tantalum target**)

L52 ANSWER 28 OF 43 HCA COPYRIGHT 2002 ACS
106:42421 High quality tantalum pentoxide films using **ultra-**

high purity tantalum sputtering target. Hashimoto, Chisato; Oikawa, Hideo; Honma, Nakahachiro (Electr. Commun. Lab., NTT, Atsugi, 243-01, Japan). Ext. Abstr. Conf. Solid State Devices Mater., 18th, 253-6 (English) 1986. CODEN: EACMES.

AB High-quality and highly reliable Ta2O5 films are obtained by using a newly developed, **ultra-high-purity Ta sputtering target**. Leakage current flowing through film 115 .ANG. is very low and does not increase even after annealing at .ltoreq.500.degree.. This film allows realization of 4-Mbit MOS d-RAM with a conventional planar cell capacitor.

CC 76-10 (Electric Phenomena)

ST tantalum **sputtering** pentoxide deposition; leakage current tantalum pentoxide film; RAM tantalum pentoxide film

IT Electric current
(leakage, of tantalum pentoxide films prepd. by tantalum **sputtering**)

IT 1314-61-0, Tantalum pentoxide
(**sputter** deposition of high-quality films of, for memory devices)

IT 7440-25-7, uses and miscellaneous
(**sputtering** of, in tantalum pentoxide high-quality films prodn. for memory devices)

L52 ANSWER 29 OF 43 HCA COPYRIGHT 2002 ACS

88:10263 Tantalum powder. Sato, Matsuji; Hiratsuka, Seiichi; Matsudaira, Yasushi (Mitsui Mining and Smelting Co., Ltd., Japan). Japan. Kokai JP 52107212 19770908 Showa, 4 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1976-23889 19760305.

AB **K2TaF7**(I) is reduced with Na and leached with a soln. at pH 2.5-5. The powder is worked to a condenser having a large electrostatic capacity. Thus, I 100 was reduced with Na 31 kg, washed with MOH, crushed to .apprx.10 mm, and 50 kg was stirred in H2O 1 m3 contg. AcOH 8 and NaOAc 5 kg, filtered, washed, and dried to obtain Ta of av. diam. 2.1 .mu. and contg. O 970 ppm. The Ta loss was 0.1-0.2% at pH 4-5, vs. 1% at pH 2. When H2O at 75.degree. was used, the O content was 3100 ppm.

IT **7440-25-7P**, reactions
(prepn. of powd., by redn. of fluorotantalate)

RN 7440-25-7 HCA

CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

IC C22B034-00

CC 54-2 (Extractive Metallurgy)

IT Electric capacitors
(tantalum powder of **high purity** for)

IT **7440-25-7P**, reactions
(prepn. of powd., by redn. of fluorotantalate)

L52 ANSWER 30 OF 43 HCA COPYRIGHT 2002 ACS
88:10262 Tantalum powder. Takase, Seikichi; Oguchi, Kinji; Matsudaira, Yasushi; Yuzawa, Masaaki (Mitsui Mining and Smelting Co., Ltd., Japan). Japan. Kokai JP 52107211 19770908 Showa, 4 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1976-23888 19760305.
AB A mixt. of **K2TaF7**(I) and alkali metal halide is melted and reduced with Na. The powder is worked to a condenser having a large electrostatic capacity. Thus, a mixt. of I 100 and KCl 80 kg was dried at 300.degree., melted at 700.degree. and 200 rpm under Ar mixed with molten Na 30 kg at 880 .+-. 5.degree., cooled, washed with MeOH and H2O and dried to obtain Ta -100 mesh 98% yield, vs. 43% and 94% when KCl was not used (at 880-950.degree.).
IT **7440-25-7P**, reactions
(prepn. of powd., by redn. of fluorotantalate with sodium)
RN 7440-25-7 HCA
CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

IC C22B034-00
CC 54-2 (Extractive Metallurgy)
IT Electric capacitors
(tantalum powder of **high purity** for)
IT **7440-25-7P**, reactions
(prepn. of powd., by redn. of fluorotantalate with sodium)

L52 ANSWER 31 OF 43 HCA COPYRIGHT 2002 ACS
83:150704 Reduced tantalum powder. Naito, Hiroo; Ohishi, Naoaki; Komatsu, Akitoshi; Koyama, Keiji (Showa Denko K. K., Japan). Japan. JP 50007006 B4 19750320 Showa, 4 pp. (Japanese). CODEN: JAXXAD. APPLICATION: JP 1969-80322 19691009.
AB Ta powder is produced by reducing stirred **K2TaF7** with Na vapor at .gtoreq.0.2 g Na/hr-cm2 reaction area. **High-purity** Ta powder is obtained. Thus, 100 **K2TaF7** was fed into a reactor contg. 35 kg Na and heated 19 hr at 860.degree. and 5 rpm. Na evapd. at 1.35 g/hr-cm2 **K2TaF7** surface. The product was cooled and extd. with H2O. Ta powder yield was 92.5%. The powder had a surface area of 520 cm2/g and contained C 25, N 53, Fe 10, Ni 10, Cr <10, an O 560 ppm.
IT **7440-25-7P**, preparation
(from potassium heptafluorotantalate, by redn. with sodium)
RN 7440-25-7 HCA
CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

IC C22B; B22F
CC 54-2 (Extractive Metallurgy)
IT **7440-25-7P**, preparation

(from potassium heptafluorotantalate, by redn. with sodium)

L52 ANSWER 32 OF 43 HCA COPYRIGHT 2002 ACS
81:52888 Powdered tantalum and niobium from the reduction of **potassium fluorotantalate** and fluoroniobate with sodium and/or potassium. Tamura, Minoru (Teijin Ltd.). Japan. Kokai JP 49034463 19740329 Showa, 6 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1972-76452 19720801.

AB In manufg. powd. Ta and Nb by reducing **K fluorotantalate** (I) and K fluoroniobate (II) with metallic Na and/or metallic K, the molten Na and/or K are added in >2 locations to the surface of the molten I and II at 5-50 g/dm2 min. The **high-purity** powd. Ta and Nb can be used in condensers. Thus, 3.2 kg molten Na (**99.9%**) under Ar was added through a distributor having 24 holes (diam. 0.5 mm) to 10 kg molten I (**99.9%**) under Ar in a reactor (diam 25 cm) at 850.degree.. The mixt. was stirred at 100 rpm while molten Na was added at 10 g/dm2 min to reduce I. After the Na had been added, the mixt. was heated for 3 hr withstirring, cooled, and treated by the conventional method to yieldpowd. Ta (>45 .mu. 8, 5-45 .mu. 89, and <5 .mu. 3%) at **99.9%** purity and 97.0% yield. In contrast, if a single tube was used for adding Na, the yield of powd. Ta was 86.6%, and the **particle -size** distribution was >45 .mu. 52, 5-45 .mu. 47, and <5 .mu. 1%.

IT **7440-25-7P**, preparation
(powd., from fluorotantalate, by redn. with sodium or potassium)

RN 7440-25-7 HCA

CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

NCL 12C243

CC 54-2 (Extractive Metallurgy)
Section cross-reference(s): 56, 71

ST **potassium fluorotantalate** fluoroniobate redn; sodium fluorotantalate fluoroniobate redn; fluoroniobate sodium potassium redn; tantalum powder fluorotantalate redn; niobium powder fluoroniobate redn

IT **7440-25-7P**, preparation
(powd., from fluorotantalate, by redn. with sodium or potassium)

L52 ANSWER 33 OF 43 HCA COPYRIGHT 2002 ACS
80:8322 Cathodic **sputtering** of tantalum. Schauer, Alois (Siemens A.-G.). Ger. Offen. DE 2215151 19731004, 9 pp. (German). CODEN: GWXXBX. APPLICATION: DE 1972-2215151 19720328.

AB **Highly pure** .alpha.-Ta films, useful for electronic devices, are formed by cathodic **sputtering** of Ta in a high-frequency discharge on Ta2O5-coated glass substrates at >300.degree. in **99.999%** Ar of 1.5 .times. 10-3 torr and a pressure of reactive foreign gases <10-6 torr. The

sputtering plasma is constricted by means of an axial magnetic field.

IT **7440-25-7**, properties
(**sputtering** of .alpha.-phase of, on tantalum oxide-coated glass substrates for electronic components)
RN 7440-25-7 HCA
CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

IC C23C; H05K
CC 71-4 (Electric Phenomena)
ST tantalum alpha **sputtering**; cathode **sputtering** tantalum
IT Electronics
(components, **sputtering** of .alpha.-tantalum films on tantalum oxide-coated glass substrates for)
IT **Sputtering**
(of .alpha.-tantalum, on tantalum oxide-coated glass substrates for electronic components)
IT **7440-25-7**, properties
(**sputtering** of .alpha.-phase of, on tantalum oxide-coated glass substrates for electronic components)
IT 1314-61-0
(**sputtering** of .alpha.-tantalum films on glass substrates coated with, for electronic components)

L52 ANSWER 34 OF 43 HCA COPYRIGHT 2002 ACS
69:110801 **Recrystallization** behavior of sintered tantalum.
Pink, Erwin; Kaerle, H. (Metallwerk Plansee A.-G., Reutte, Austria). Planseeber. Pulvermet., 16(2), 104-7 (German) 1968. CODEN: PLPUA5.
AB Thin plates (.apprx.1 mm.) were **recrystd**. in vacuum (10-6 torr) for one hr. at 1400.degree. and then stretched up to 60%. For stresses >60%, cold worked wires were used. After deformation the samples were heated for 1/2 hr. in vacuum, and the av. crystal size detd. as a function of temp. Sintered Ta behaves similarly to other **high purity** metals. For small deformations, grain growth increases markedly at the **recrystn**. temp. No distinctive secondary grain growth was observed at temps. >1800.degree. for large deformations. Depending upon the degree of deformation, **recrystn**. starts between 800 and 1000.degree.. It was not possible to det. the **grain size** by metallographic methods in the case of medium deformation; consequently, x-ray back reflection techniques were used. The difference between the **recrystn**. temp. of fused Ta at 1200.degree. and of sintered Ta is explained by assuming different distributions of impurities. In contrast to sintered Mo and W, where the **grain size** remains const. when heating the undeformed material, the **grain size** of undeformed Ta increases constantly from 1400.degree. onwards. This is explained by different solubilities and (or) distribution of

impurities.
IT **7440-25-7**, properties
(**recrystn**. of, grain growth in)
RN 7440-25-7 HCA
CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

CC 70 (Crystallization and Crystal Structure)
ST sintered Ta; tantalum sintered **recrystn**
IT **Recrystallization**
(of tantalum, grain growth in)
IT **7440-25-7**, properties
(**recrystn**. of, grain growth in)

L52 ANSWER 35 OF 43 HCA COPYRIGHT 2002 ACS
67:56643 Production of **high-purity** electrolytic tantalum powder. Konstantinov, V. I. Khim. Tekhnol. Redkomet. Syr'ya, 108-13 (Russian) 1966. CODEN: 16LFAV.

AB Ta or Ta-Nb alloy powder is produced by the electrolysis of a mixt. of **K2TaF7**, KCl, and KF with the periodic addn. of Ta2O5 and Nb2O5 (CA 58: 4162d). The principal impurities in the Ta powder are Fe and Si, which come from the salts. **K2TaF7** and Ta2O5 were obtained from products of treatment of loparite conc. with H2SO4 and extn. with cyclohexanol or Bu3PO4 and contained, resp., Nb 0.1, Ti 0.01, Si 4-8 .times. 10-3, Fe 4 .times. 10-3-1 .times. 10-2, W 1 .times. 10-3, and Mo 1 .times. 10-3, and Nb 0.1, Ti 0.01, Si 0.01, Fe 0.01, W 0.002, Mo 0.002, and F 0.5-1%. KCl (chem. pure) and KF (pure) were purified by crystn. and contained, resp., Si <0.0025 and Fe 0.0001%, and Si .ltoreq.0.004 and Fe .ltoreq.0.0005%. The electrolysis was carried out in a lab. cell contg. 2.6 kg. of electrolyte. With one portion of electrolyte, 13 cycles of electrolysis were made with the addn. of 800-1500 g. Ta2O5 before each cycle. The purity of the powder improved considerably after the 1st cycle. The product contained Nb 0.13, Ti <0.01, Si <0.01, Fe <0.01, W 0.002, Mo 0.005, and C 0.12%. The particle size distribution was >74 .mu. 34, 44-77 .mu. 18, and <44 .mu. 48%. The >74-.mu. fraction was converted into hydride, ground to <44 .mu., and dehydrogenated. The C content can be reduced 3-4 times by vacuum sintering at 1800-1900.degree. or treatment with H2SO4 plus H3PO4 plus CrO3.
IT **7440-25-7P**, preparation
(from loparite by leaching, extn. and electrolysis)
RN 7440-25-7 HCA
CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

CC 56 (Nonferrous Metals and Alloys)
IT **7440-25-7P**, preparation

(from loparite by leaching, extn. and electrolysis)

L52 ANSWER 36 OF 43 HCA COPYRIGHT 2002 ACS
66:43142 Tantalum powder for sintered porous capacitor anodes. Fincham, Christopher J. B.; Villani, Gerard J. (National Research Corp.). U.S. US 3295951 19670103, 6 pp. (English). CODEN: USXXAM. APPLICATION: US 19630709.

AB Such anodes for liquid and solid electrolytic capacitors, having low leakage, high capacitance, and high breakdown voltage, are formed from small compact nonporous particles of **high-purity** Ta, heat-treated to take most of the impurities into solid soln., sintered with min. shrinkage, and anodized to high voltage for continuous, comparatively thick, oxide films. Freedom from undissolved impurities is attained by arc or **electron-beam melting**, or by long high-temp. homogenization, and the solid metal is pulverized, preferably by milling to fine chips, which are cleaned with trichloroethylene, aqua regia, and HF + H2O2, then hydrided, preferably by cooling slowly in H from .apprx.700.degree. to 300.degree., and milled with Ta balls in water to the desired fineness. Finally, the powder is leached with an aq. soln. contg. 1% HF and 2% H2O2 to remove excess O, and degassed at <1 .mu. pressure for several hrs. at 300-700.degree.. The hydriding can also be done with acid such as HF, but at the cost of .ltoreq.15% metal loss. Satisfactory powder produced in this way contained O 993, N 48, Si 35, C 20, H 13, Fe 8, Al and Nb each <25, Mo <10, and other impurities .ltoreq.5 ppm. When pressed to a small pellet which was polished and anodized 30 min. at 100 v. in 0.01% H3PO4 to a blue film, the film was uniformly colored and not pitted, indicating the absence of impurities not in solid soln. The **particle size** and shape were also satisfactory as detd. by several test methods which are described in detail. Anode pellets were pressed to 1/4-in. **diam**. from this **powder** having 9.4-.mu. av. **particle size**, with sufficient pressure for coherence and a d. of 9.5 g./cc. The anode pellets were sintered 1.5 hrs. in H at 0.1-.mu. pressure and 1930.degree. and then anodized in 0.01% H3PO4 at 90.degree. with 35 ma./g. to 200 v. until the current dropped to 12 .mu.amp./g. The anodizing was continued 1 hr. at 12 .mu.amp./g. and 270 v. Standard testing methods showed 1.19 .mu.amp./g. leakage, 7 .mu.f./g. capacitance, 8.8 ohms ESR (ESR = D/2 .pi. FC, where D is the dissipation factor, F the frequency of the a.c. signal, and C the capacitance; the ESR detns. were at 120 cycles/sec. with a 0.5 v. a.c. signal). and 320 v. breakdown voltage. The properties of 2 other samples contg. Fe 170, Ni 160, Si 390, and W 292, or N 210, and C 27 ppm. in solid soln., similarly processed and tested, were also acceptable. When 100 ppm. 100-mesh W powder, with or without 63 ppm. N as TaN, was mixed into the above homogeneous hydrided and degassed powder, or when powder prepd. according to U.S. 2,950,185 (CA 55, 338d), or Ta powder com. available, was used for the anodes, and processed and tested similarly, attempts to anodize at 270 v. failed, the breakdown voltage being 100-204 v., compared to 264-320 v. for anodes prepd.

according to this improved process.
IT **7440-25-7P**, uses and miscellaneous
(manuf. of powder, for capacitor anodes)
RN 7440-25-7 HCA
CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

NCL 075005000
CC 77 (Electrochemistry)
IT **7440-25-7P**, uses and miscellaneous
(manuf. of powder, for capacitor anodes)

L52 ANSWER 37 OF 43 HCA COPYRIGHT 2002 ACS
66:21525 Production and properties of single crystals of refractory metals and alloys. Savitskii, E. M.; Burkhanov, G. S.; Kopetskii, Ch. V.; Bokareva, N. N.; Kardashevskaya, V. G. Svoistva Primen. Zharoprochn. Splavov, 15-24 (Russian) 1966. CODEN: 16CXA6.
AB By employing the method of **electron beam** zone **melting** in vacuo and **recrystn**. single crystals of V, Nb, Ta, Mo, W, Re, and Ru, as well as Mo-Nb, Mo-W, and W-Nb were produced. The purity of the single crystals was verified by measuring the residual elec. resistance at 4.2.degree.K. or by measuring the no. of bendings at 90 or 180.degree.. **Increased purity** resulted in considerable decrease of tensile strength, and hardness as well as increase of plasticity and elasticity modulus. Single crystals of W and Mo exhibited anisotropy of tensile strength and plasticity, e.g. min. relative elongation 2% and constriction 0% in the direction (100) and max. elongation 10-12% and constriction 100% in the direction (110). 17 references.
IT **7440-25-7**, properties
(crystal growth of, and properties of single crystals)
RN 7440-25-7 HCA
CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

CC 56 (Nonferrous Metals and Alloys)
IT 7440-03-1, properties 7440-15-5, properties 7440-18-8, properties **7440-25-7**, properties 7440-33-7, properties 7440-62-2, properties
(crystal growth of, and properties of single crystals)

L52 ANSWER 38 OF 43 HCA COPYRIGHT 2002 ACS
63:37611 Original Reference No. 63:6674b-d **Electron-beam melting**, deformation, and **recrystallization** of niobium and tantalum. Zedler, Erich; Mueller, Dieter; Wiesner, Ulrich (Deut. Akad. Wiss., Berlin). Z. Metallk., 56(5), 316-19 (Unavailable) 1965.

AB The various parameters influencing the quality of **electron -beam-melted** Nb and Ta are discussed. The interstitial impurity content of the starting material had little influence on the concns. obtained after **electron-beam melting**. The most important parameter was the pressure prevailing during melting. All Nb samples melted in vacuo above 2 .times. 10-4 torr are high in interstitials, therefore brittle, and could not be rolled at room temp. **Ta metal** was not quite as sensitive as Nb, and a Ta sample which was **electron-beam melted** under a 5 .times. 10-3 torr vacuum could be rolled at room temp. without intermediate anneals. For studying the **recrystn**., deformed samples of Nb and Ta were annealed at various temps. at a const. 1 .times. 10-5 torr pressure followed by hardness and tensile strength measurements. The region of **recrystn**. ascertained for the 2 metals was somewhat lower as compared to values found by other authors (Kvernes, CA 59, 13657c). This discrepancy can be explained by the **higher purity** of the metals employed in this investigation. The **recrystn** . of deformed (85-95%) Nb was completed after annealing at 900.degree. for 1 hr. For deformed Ta, the corresponding values were 1100.degree. for 1 hr.

CC 20 (Nonferrous Metals and Alloys)

IT Electrons
   (beams or rays of, Nb and Ta melted by, deformation and **recrystn**. of)

IT Crystallization
   (re-, of Nb and Ta after **electron-beam melting**)

IT 7440-03-1, Niobium
   (crystn. (re-) of **electron-beam melted**)

L52 ANSWER 39 OF 43 HCA COPYRIGHT 2002 ACS

62:28219 Original Reference No. 62:4995d-f The preparation of **high-purity** tantalum. Kolchin, O. P.; Berlin, I. K. At. Energ. (USSR), 17(5), 400-5 (Russian) 1964.

AB An investigation was made of the last stage in the production of very pure **Ta metal** by the method of K. and Chuveleva (CA 53, 13955a); the Ta particles were sintered at 2700-50.degree. in vacuo (5 .times. 10-3-5 .times. 10-4 mm.) and the degree of purification was measured as a function of the sintering time. By using samples of known initial content of impurities, it was found that in the case of **particles** with a **size** of 10 .times. 10 mm. the sintering time should be 2-3 hrs.; the sintering did not reduce the initial Nb content, but the sintered samples contained only 4.6 .times. 10-5% H, (1-5) .times. 10-3% O, (3-8) .times. 10-3% C, and (6-11) .times. 10-3% N. Although Ti, Fe, Si, Mn, Al, Sn, Cu, Zn, As, Cr, Mg, Ca, Pb, Sb, Bi, Cd, S, and P were added before the sintering in amts. of 0.03-3.0%, their concns. in the sintered samples were below the limit of detection of the anal. methods used. The porosity of the Ta was

reduced from 23-33% after 1 hr. of sintering to 5-6% after 4-5 hrs.; most of the porosity was open. The Ta produced by the above method was quite ductile, and after short-time annealing at 2450.degree. could be cold-worked readily into bands, foils, etc. The Ta produced by the above method was purer than Ta produced by **electron-beam melting**; an added advantage is the fact that the above process does not require that the Ta2O5 taken as a raw material be of a **high** degree of **purity**.

CC 20 (Nonferrous Metals and Alloys)

L52 ANSWER 40 OF 43 HCA

57:3103 Original Reference No. 57:543f-i,544a Some properties of molten and sintered tantalum. Raub, Ernst; Roeschel, Erich Z. Metallk., 53, 93-103 (Unavailable) 1962.

AB Massive **Ta metal** samples were prepd. from Ta powder by various techniques such as sintering, **electron-beam melting**, arc **melting**, or combinations of such techniques. Purity and phys. properties of the samples were then compared. **Electron-beam-melted** Ta had the lowest gas content, somewhat comparable with the gas content of sintered Ta. The changes in hardness after cold deformation by rolling showed nonlinearity, a phenomenon observed also for other metals, such as Ag (Roll and Motz, ibid. 46, 872(1955)). Electron-beam-prepd. Ta showed the smallest increase in hardness after cold deformation. If the cold-deformed samples were annealed, regeneration from the deformation occurs, as evidenced by lower hardness values. The **recrystn**. occurring in cold-deformed Ta during annealing is illustrated by numerous micrographs. In electron-beammelted and deformed Ta, **recrystn**. was observed after annealing at 600.degree. for 4 hrs. If sintered Ta was similarly deformed, **recrystn**. occurred if the annealing temp. was raised to 1000.degree. for 1 hr. Sintered Ta has a finer **grain size** than Ta that was previously in the molten state. The sp. elec. resistance of sintered Ta is considerably higher than the resistance of previously molten **Ta metal**. If cold-deformed, sintered Ta is heated to the **recrystn**. temp., a slight decrease (about 1%) in the elec. resistance was observed. **Electron-beam-melted** Ta having a low gas content displayed an opposite behavior, e.g. the elec. resistance increased. The strength at elevated temp. of cold-rolled and **recrystd**. Ta samples was compared. **Electron-beam-melted** Ta had less strength at higher temp. than **Ta metal** obtained by sintering. Less-pure Ta with a high gas content has therefore a greater strength at elevated temps. than **high-purity** (electron-beam-refined) metal.

CC 21 (Nonferrous Metals and Alloys)

L52 ANSWER 41 OF 43 HCA

55:1827 Original Reference No. 55:295g-i Mechanical properties of **tantalum metal** consolidated by melting.

Schussler, Mortimer; Brunhouse, Jacob S., Jr. (Union Carbide Corp., Niagara Falls, NY). Trans. Met. Soc. AIME, 218, 893-900 (Unavailable) 1960.

AB Arc-**melted** and **electron-beam melted** Ta in the cold-worked and the **recrystd.** conditions show high strength, good tensile ductility, and excellent notch toughness down to -321.degree.F. Arc-melted material, contg. moderate amts. of interstitials, possesses better short-time strength than **higher purity electron-beam-melted** material up to 2000.degree.F. Cold-working substantially strengthens arc-**melted** Ta, whereas **electron-beam melted** material exhibits a low work-hardening rate and possesses better formability characteristics. With identical compns. and microstructures, the mech. properties of **melted** Ta and **vacuum** -sintered Ta should be similar.

CC 9 (Metallurgy)

L52 ANSWER 42 OF 43 HCA COPYRIGHT 2002 ACS

25:32200 Original Reference No. 25:3573d-f Preparation of metal powders by electrolysis of fused salts. III. Tantalum. Driggs, F. H.; Lilliendahl, W. C. Ind. Eng. Chem., 23, 634-7 (Unavailable) 1931.

AB cf. C. A. 25, 644. **Ta metal** of a **high** degree of **purity** was obtained by electrolysis of Ta2O5 dissolved in **K2TaF7**. Addn. of KCl to the bath increased the coarseness of the deposit. A graphite crucible was used as anode, and the Ta was deposited upon a Mo or Ni cathode suspended in the center of the crucible. The deposit consisted of about equal proportions of Ta and solidified salt. The salt was removed with water, and the Ta was left as a fairly coarse powder. Traces of graphite in the deposit were removed by boiling with a mixt. of concd. HNO3 and H2SO4 until SO3 was evolved. The Ta thus obtained contained C 0.06, Fe 0.02, Ni 0.01 and Mn 0.002% as impurities. Pressing, sintering and degasifying of Ta by heat treatment in vacuo are necessary to obtain ductile metal. The Rockwell hardness of a heat-treated bar is between B30 and B40. Ta was plated successfully on Fe, Ni and Mo.

CC 4 (Electrochemistry)

L52 ANSWER 43 OF 43 HCA COPYRIGHT 2002 ACS

10:2886 Original Reference No. 10:546c Work of the Physikalisch-Technische Reichsanstalt in 1914. Warburg; Muller Z. Elektrochem., 21, 501-11 (Unavailable) 1915.

AB cf. C. A. 9, 3148-51. Radiation measurements: improvements in the methods The investigations of vacuum radiation were continued, and the following improvements proposed: (1) To det. constancy of temp. of the vacuum radiator and of other cases in which the thermoelectric method is not applicable, a special form of bolometer (Haltebolometer or Mittelblockbolometer) is used. The instrument is set in a larger water bath so that the furnace radiation must penetrate a greater H2O layer, the bath being kept at const. temp. by an elec. thermoregulator. (2) The formula previously reported (C.

A. 7, 3700) for calcg. spectral intensity measurements with the mirror spectrometer was based on expts. with freshly silvered mirrors; this is not exactly correct as the reflectivity diminishes with the age of the mirrors. In a new series of expts. on the reflectivity of the mirrors, the wave lengths were measured by the method of Hagen and Rubens. Determination of the constant c. Applying the above improvements to the methods previously used (C. A. 7, 3700), new detns. of c were made with: (1) the vacuum-carbon radiator between the m. p. of Au and 1400.degree., and the m. p. of Au and 1700.degree.; (2) the Lummer-Kurlbaum open radiator between m. p. of Au and 1400.degree.; (3) the L.-K. model with linear dimensions of double size, but with relatively smaller opening of the inner screen, between same temp. limits. The new expts. show a better agreement among themselves than the old and give a smaller value to c, to be published later. All expts. were made with the new quartz prisms. Recent expts. of Paschen show deviations from the Carvallo dispersion formula in the 5th decimal place of the refraction exponent sufficient to make changes of almost 1% in the value of c. Temperature determinations according to the Wien displacement law and the Stefan-Boltzmann law Using the large L.-K. model, detns. were made at the same temp. according to the Wien law and according to the Stefan-Boltzmann law; the diam. of the furnace opening was increased from 5 to 10 mm. and the bolometer was placed in the center of a reflecting Ni hemisphere. Under these conditions the temp., detns. by both methods based on the Carvallo dispersion curve were almost in complete agreement. Light unit. A rational light unit can be obtained only through vacuum radiation, holding the radiator at a temp. of about 2000.degree.. Expts. have been initiated with the vacuum-C radiator, holding the temp. const. with the improved bolometer. For reproducing the temp. the method of Lummer and Kurlbaum was used in which a definite reduction of the total radiation is effected by absorption. For this a 2 cm. thick layer of a 10% $K_2Cr_2O_7$ soln. between quartz plates was used. The light radiation could be reproduced up to 0.4%. Further work is in progress. Energy law of photochemical processes (Warburg). See C. A. 9, 883, 2348, 3149. bsorption of ultraviolet radiation See C. A. 8, 613; 9, 2480, 2836 Measurement of .epsilon./.mu. (Gehrcke and Janicki). Further work is reported on the cathode dusting method. Metal plates of Pt, Au, Cu, and Zn were subjected to the rays of a Hg quartz lamp in vacuo and studied to det. the reproducibility of the potential charges of the plates. The charges were reproduced only when the plates were thoroughly "cleansed" by previous cathode dusting. The potential charge depends mainly upon the gas in which the dusting has been effected and only slightly upon the metal. After dusting in H the highest potential was found, viz., 2.44 V. for Pt, Au, Cu; 2.62 v. for Zn. Dusting in H_2O vapor gave lower and less const. values of 1.8 to 2.3 v.; in He the lowest value (1.8 v.) was obtained. These potentials were reproducible and stable for hrs., as long as the vacuum was held const. by liquid air. It was immaterial whether liquid air or liquid H, with or without coconut charcoal, was used in producing the vacuum. No reproducible potentials could be obtained with Al. Light emission of metal

vapors in the **glow discharge** (Janicki and Seeliger). In the emission spectra of Cd, Zn, Mg, Pb, Al, Sn, Ag and Si there is a parallelism on the one hand between sparks and negative glow, on the other between arcs and positive columns; Te shows no such analogy. Expts. with Zn and Cd in externally heated Geissler tubes with inner electrodes confirmed the results with these 2 metals. Testing of radioactive preparations (Geiger, Bothe and Janicki). The total content of 395 strongly radioactive prepns. examd. corresponded to about 8230 mg. Ra element (including 49 meso-Th prepns. with a Ra equiv. of 1181 mg.); 102 prepns. at time of examn. were not yet in radioactive equil.; 13 feebly radioactive prepns. tested contained amts. of Ra of the order of magnitude of 10-5 to 10-4 mg. Ra element per g. of substance. Apparatus for testing feebly radioactive preparations (Bothe). See C. A. 9, 3026. Theory of the normal elements (von Steinwehr, Kohnstamm and Cohen) (Wied. Ann. 65, 344(1899)) and Holsboer (Z. physik. Chem. 39, 691(1902)) have reported a transformation point at 15.degree. for 3CdSO4.8H2O; the work and conclusions of these authors are critically discussed, calcns. from their data giving a much lower temp. than 15.degree.. New measurements were made of the differential heats of diln. of CdSO4 solns. and the temp. coefficients of this heat tone calcd. From these data and older values the theoretical heat of soln. and its temp. coeff. were computed; from these 2 magnitudes the temp. of the change of sign of the theoretical heat of soln. and the minimum soly. agree to +3.degree. with the soly. expts. of Mylius and Funk (Ber. 30, 825(1897)). In the calcn. of the chem. energy the new values for the e. m. f. of the elements were used (electrochem. equiv. of 96494 (instead of 96540), elec. equiv. of heat = 0.2389). The results (47252 cal. calorimetrically and 47427 cal. electrically) show better agreement than earlier values. Calorimetric detns. of the temp. coeff. of the chem. energy of the elementsgave +19.45 cal./degree; electrical detns. using the temp. formula of Jaeger and Wachsmuth for the Weston element gave +17.44 cal./deg. The Wolff formula gave +21.10 cal./deg. This shows that Cohen's criticism (C. A. 5, 1014) of the Jaeger temp. formula is not tenable. Cf. C. A. 8, 3146; 9, 3149. Mercurous sulfate (v Steinwehr). Hg2SO4 is prepd. in large amts. for normal elements by E. de Haen, Hannover, under the supervision of the Reichsanstalt. The salt is kept under a satd. soln. of CdSO4 (cf. Warburg, C. A. 9, 1007). Silver voltameter (Jaeger and v. Steinwehr). A note describing briefly the different forms of Ag voltameter and calling attention to the work set forth in other publications (cf. Rosa et al., C. A. 8, 3154). Mercury resistance thermometer: change of resistance of Hg between 0 and 100.degree. (Jaeger and v. Steinwehr). See C. A. 8, 2297; 9, 749. Theory of mercury rectifiers (Jaeger). The oscillographic curve for electrolytic and Hg rectifiers has been investigated with a view to detg. the "minimum potential" which must be overcome. Current and voltage curves of Hg rectifiers in different combinations with ohm resistance, capacities and inductances are calcd. and explained with figures. Cf. Schulze, C. A. 9, 24, 24, 1007. Weak-current laboratory See normal elements, C. A. 9, 3150.

Electrical measuring technics laboratory (Feuszner). A description of a new lab. and its equipment. Comparison of platinum and helium thermometers below -193.degree. (Henning) The work previously reported (cf. C. A. 7, 2892) has been continued. Different resistance thermometers were compared with a He gas thermometer in baths of liquid air and liquid H, which boiled under normal or reduced pressure. For the intervals 80.degree. and 62.5.degree., and 20-3.degree. and 16.4.degree. abs. temp. the resistance ratio (Pt thermometer No. 30) R = r/ro as a function of the abs. temp. T may be calcd. by the empirical equation log (R-0.0038) = -1.71496 + 0.76176 log T -(34-985/T) with an accuracy of about 0.02.degree.. This formula has not been tested for the interval between T = 62.5 and 20.3.degree.. With Pt wires of same m. p. as No. 30, the equation holds with approx. the same consts. (cf. Henning, C. A. 9, 3148). The quadratic reduction formula for R of different thermometers held above -193.degree. (at b. p. of O and at b. p. of CO2) regardless of the variety of Pt; at lower temps. it does not suffice for all the varieties of Pt, e. g., 2 varieties of Heraeus very pure Pt at the b. p. of H gave R at T = 20.3.degree., 0.0060 and 0.0082. Boiling point of hydrogen (Henning) The normal b. p. of H was detd. by immersing a He thermometer directly in the boiling liquid. The results were the same whether the liquid was stirred or not. Measurements agreeing within the limits of observation (0.02.degree.) with 2 different fillings of the gas thermometer (initial pressure po = 740 mm.) gave the normal b. p. t = -252-797.degree., reduction to 760 mm. being calcd. by the coeff. of Onnes, dt/dp = 0.005.degree. per mm. Applying the correction calcd. by Berthelot's method (+0.004.degree.) for the thermodynamic scale the normal b. p. on this scale t = -252.79.degree.. This result is not final as the thermal coeff. of expansion of the gas thermometer vessel (Jena glass 59III) was based on a value which by extrapolation gave an equation holding only to -193.degree.. Onnes and Keesom. in 1913 reported the normal b. p. of H on the thermodynamic scale = -252-76.degree.. Comparison of different gas thermometers (Hennin). Const. vol. H, He, and N thermometers were indirectly compared with one another by means of Pt resistance thermometers. The results together with previous measurements at 445.degree. in which A thermometers were investigated, are reported in a table, the He, N, or A thermometers giving higher readings than the H. The results were calcd. by the formula ti-t = Po(Tc3/Pc) 1 517 10-8 [t(t-100)/(t + 273)], which according to the Berthelot equation of state, gives the temp. difference ti-t of the thermodynamic scale (ti) against the scale of a gas thermometer of const. vol. (t) at the initial pressure po. Tc and Pc are the abs. critical temp. and press. of the gases. The results show that the B. equation does not present with sufficient accuracy the deviations of the different gas thermometers within the observed temp. range. Measurements with platinum thermometers in Leiden and Teddington (H. Schultze) Three Pt thermometers of the Reichsanstalt were taken to Onnes' laboratory at Leiden and to the Natl. Physical Lab. at Teddington. In Leiden the resistance thermometer No. 35 (Pt exceptionally pure) was measured at the temp. of liquid H, which

boiled under reduced pressure between 20.3.degree. and 14.7.degree. abs. The temp. was detd. from the vapor pressure of H, which, according to the measurements of Onnes and Keesom, is a function of the temp. measured in the thermodynamic scale. Measurements with the same instrument at the Reichsanstalt gave R = 0.006006 at T = 20.28.degree. (He scale); by interpolation of the Leiden observations this value of R corresponds to 20-33.degree. (0-05.degree. higher). Aside from exptl. difficulties this difference is explained by the difference of the temp. scale of the Leiden lab. and the Reichsanstalt, O. and K. using a value for normal b. p. of H 0.03.degree. higher. Harker in the Natl. Physical Lab. has tested Pt thermometers Nos. 10 and 18 at the b. p. of S. The measurements were made with 2 b. p. app., one of Fe, the other of glass. The Reichsanstalt measurements were made in a glass boiling-tube, the av. results of a series of concordant measurements being reported. The results of the 2 institutions show good agreement. Specific heats of gases at low temperatures (Heuse) The sp. heat. of A at a pressure of 1 atm.: at + 20.degree. = 0.1263 g. Cal. 15/g. degree, at -180.degree. = 0.1317 g. Cal. 15/g. degree. From Berthelot's equation for the ratio of the sp. heats in ideal gases, x at 20.degree. = 1.651. The deviation of this value from that (1.667) for monoatomic gases by the kinetic gas theory is of the same significance as was observed with He (cf. C. A. 9, 3148). Equation of state of gases (Holborn and H. Schultze) Cf. C. A. 10, 416. The pv value for pure He was detd. at 0.degree. , 50.degree., and 100.degree. for pressures of 19 and 38 m. of Hg. Within these limits the isothermals are rectilinear; the values of Onnes at 0.degree. and 100.degree. within this pressure range show deviations up to 0.1% from the rectilinear. Expts. were interrupted by the war. In order to check the pressure measurements within an accuracy of 0.03%, the pressure balance, which had been compared with a Hg manometer at 16 atm., was tested for higher pressures. For this purpose 2 similar balances, standardized as above, were compared with one another at pressures up to 200 atm., showing a variation with the pressure and necessitating a direct comparison with the Hg manometer which is outlined. Specific heats of gases at high pressure (Holborn and Jacob) Expts. on the av. sp. heat of air between 20.degree. and 100.degree. were extended to 300 atms., but the outbreak of the war has interrupted the work. Liquefaction of hydrogen and helium (Meissner) Improvements in the plant for the liquefaction of gases have reduced the amt. of liquid air used for precooling in the liquefaction of H from 2.5 to 1.75 l. per hr. During the yr. 33 l. of liquid H were produced. According to Onnes the production of a few hundred cc. of liquid He requires 25 l. of liquid H, the production of which requires about 75 l. of liquid air. An investigation is in progress looking to a simpler and more economical process. Expts. without definite results have been made on the liquefaction of H without precooling with liquid air, based on the use of the external performance of the compressed H. In the liquefaction of He the precooling with liquid H cools the He to a little below the inversion point for the Joule-Thomson effect, so that the latter is very small; an improvement appears possible by

the use of the external performance of the compressed He, e. g., on a turbine as suggested by Rayleigh. The testing of laboratory and other thermometers (Meissner) (normal, metereological, calorimeter, etc.) is reported, number of tests made and accuracy required being given. Seven per cent. of thermometers tested were rejected. Comparison of mercury with platinum thermometers between 0.degree. and 100.degree. (Holborn and Scheel) A series of Hg thermometers were compared among themselves and with 3 Pt resistance thermometers in the interval 0.degree. to 100.degree.. Two thermometers of the verre dur of the Internatl. Bureau, 2 inclosed scale thermometers of Jena glass 16III and rod thermometers of Jena glasses 16III and 59III, were tested. Results are reported in a table, the values agreeing for each temp. (20.degree., 40.degree., 50.degree., 75.degree.) within the limits of error of about 0.005.degree. for the 3 scales (internatl. H scale, testing lab. scale and the scale used in the radiation measurements above). Comparison of mercury and platinum thermometers between 100.degree. and 300.degree. (Hoffmann and Meissner) See C. A. 9, 2331. New thermometer glasses (scheel, Grutzmacher and Moeller) The work is progressing, though not completed, owing to the personal supervision required in the factory and the time and care necessary in the calibration. Twelve normals of different glasses have been calibrated and compared; the softening temp. and expansion of some glasses were detd. dilatometrically; one glass is being tested for the manuf. of clinical thermometers. Electrical and optical temperature measurements (Hoffmann and A. Schulze) Tests reported on thermoelements, using 3 elements of Pt-(Pt-Rh) from 100.degree. to 1100.degree. as instruments of precision. Two elements of constantan-Cu and I element of constantan-Fe below 0.degree. were tested; 8 elements of constantan-Fe and 1 of constantan-W up to 800-900.degree. were tested, two of Ni-(Ni-Cr) up to 1100.degree.. A study of the behavior of thermoelements of the base metals on continued heating at high temps. in the elec. furnace showed that in elements consisting of strong tubes or rods the thermal force did not change more than 5.degree. to 10.degree.; such constancy can be attained only when the element, before being used for temp. measurements, is heated throughout its length in order to reduce any irregularities (lack of homogeneity). Elements of constantan-Fe, constantan-steel tube, and Ni-35% Ni steel withstood a temp. of 800.degree. for 250 to 300 hrs.; an element of Ni-66% Ni steel withstood 1000.degree.. Elements of Ni-C for an av. of 275 hrs. at a temp. of 1200.degree. did not change more than 10.degree.; Ni-(Ni-Cr) (10% Cr) at 1000.degree. for longer periods changed not over 10.degree.. The thermo-electric behavior of W, Mo, and Ta is being studied. Special tests (Moeller and Hoffmann) The heats of combustion of lamp filaments of W and W powder were detd. The m. p. (273.degree.) of Bi prepd. in the lab. was detd. by sealing the metal in a glass tube; the m. p. and solidifying point were detd. with a thermoelement. Chemical work. Preparation of pure metals (Mylius) The work of the Reichsanstalt has enabled German factories to produce the following metals of great purity: Hg, Ag, An, Pt, Cu, Sn, Zu, Cd, Pb, Bi, Sb, Fe, Ni, Co, Ir, Rh, Ru, Os. The impurity of

the factory products never exceeds 1: 104. The prepn. of pure Pt from Na2PtCl6 was accomplished by Mylius and Foerster (Ber. 25, 665(1892)); methods of Pt analysis (cf. C. A. 9,419). The Pt of commerce always contains numerous impurities in small amts., e. g., Heraeus purest Pt contains traces of Ir, Pd, Au, Cu and Fe (= 1:04 impurity). Readily detectable amts. of Pt, Ag, Sn and Zu are normally present in the pure electrolytic Bi, while Kahlbaum's purest Bi (in 1914) prepd. by chemical methods contained as impurities: Ag trace, Cu 0.001%, Pb and Ve traces (= 1:104-5). A table is given showing amts. of impurities in Bi from various sources. The sp. elec. resistance of Bi wire from Hartmann and Braun was found by Steinhaus and Werner to be 1.290 at 22.degree.; of Bi prepd. by Lenard's process (Ann. Physik. Chem. 39, 642(1890)) varies from 1.088 to 1.157. Groschuff's work on a commercial Sb shows the need for improved chemical methods. For the sepn. of Sb from its solns. it is suggested that one use the H2O-decomposable, crystd. compd. of SbCl55 with HCl, which is pptd. by passing in HCl-gas. The impurities are concd. in the mother-liquor and then detd.

Kahlbaum's "technical" Sb contains as impurities Cu, Pb, Fe, Ni, Co, Sn, and As (impurity = 1:102); K.'s "pure" Sb is of higher purity, but the ratio of the impurities to Sb has not been established. Nickel and cobalt (Mylius and Huttner). Expts. on the purification of impure Ni and Co by the crystn. of the simple salts (nitrates, chlorides, sulfates, etc.) resulted more in the removal of impurities (Cu, Fe, Mn, Zn, etc.) than in the sepn. of Ni and Co, as the salts of the latter are very similar in soly. and readily form mixed crystals. For the complete sepn. and purification, complex compds. characteristic of i metal only must be used: for Ni the rose colored double nitrite Ni(NO2)2(NH3)4; for Co the purpureo salt Co(NH3)5(NO3)3. The use of these and other salts is being studied. Platinum substitutes (Groschuff and Lenz) Wires of Pt-Ag alloys have been tested for use in incandescent lamps. Time expts. with such wires containing 25% Pt have been conducted with reference to the required "vacuum density."

CC 2 (General and Physical Chemistry)

=> d l59 1-15 cbib abs hitstr hitind

L59 ANSWER 1 OF 15 HCA COPYRIGHT 2002 ACS

135:69749 Intermetallic aluminides and silicides articles, such as **sputtering** targets, and methods of making same with **high purity** and good stoichiometry. Shah, Ritesh P.; Morales, Diana L.; Keller, Jeffrey A. (Honeywell International Inc., USA). U.S. US 6258719 B1 20010710, 11 pp. (English). CODEN: USXXAM. APPLICATION: US 1998-108610 19980701.

AB Described is an in situ method for producing articles of metal aluminide or silicide by reactive sintering and vacuum hot pressing powders and products, such as **sputtering** targets, produced.

IT **7440-25-7**, Tantalum, processes

(intermetallic aluminides and silicides articles, such as **sputtering** targets, and methods of making same with **high purity** and good stoichiometry)
RN 7440-25-7 HCA
CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

IC ICM H01L021-44
NCL 438682000
CC 76-12 (Electric Phenomena)
ST aluminide silicide **sputtering** target
IT Sintering
(hot pressing; intermetallic aluminides and silicides articles, such as **sputtering** targets, and methods of making same with **high purity** and good stoichiometry)
IT Powders
Rapid thermal annealing
Sputtering targets
(intermetallic aluminides and silicides articles, such as **sputtering** targets, and methods of making same with **high purity** and good stoichiometry)
IT Intermetallic compounds
Silicides
(intermetallic aluminides and silicides articles, such as **sputtering** targets, and methods of making same with **high purity** and good stoichiometry)
IT Sintering
(reactive; intermetallic aluminides and silicides articles, such as **sputtering** targets, and methods of making same with **high purity** and good stoichiometry)
IT Etching
(selective; intermetallic aluminides and silicides articles, such as **sputtering** targets, and methods of making same with **high purity** and good stoichiometry)
IT 7727-37-9, Nitrogen, uses
(intermetallic aluminides and silicides articles, such as **sputtering** targets, and methods of making same with **high purity** and good stoichiometry)
IT 7429-90-5, Aluminum, processes 7439-89-6, Iron, processes 7440-02-0, Nickel, processes 7440-21-3, Silicon, processes **7440-25-7**, Tantalum, processes 7440-32-6, Titanium, processes 7440-48-4, Cobalt, processes 7440-59-7, Helium, processes
(intermetallic aluminides and silicides articles, such as **sputtering** targets, and methods of making same with **high purity** and good stoichiometry)
IT 7429-90-5DP, Aluminum, intermetallics, processes 11104-62-4P, Cobalt silicide 11129-80-9P, Platinum silicide 12004-78-3P 12039-13-3P, Titanium sulfide (TiS2) 12039-88-2P, Tungsten silicide (WSi2) 12626-44-7P, Chromium silicide 12704-83-5P,

Aluminum compd. with nickel 12737-81-4P, Aluminum compd. with iron 12738-91-9P, Titanium silicide 37217-74-6P, Aluminum compd. with cobalt 39467-10-2P, Nickel silicide 52953-72-7P, Tantalum silicide 121339-47-7P, Aluminum compd. with tantalum
(intermetallic aluminides and silicides articles, such as **sputtering** targets, and methods of making same with **high purity** and good stoichiometry)

IT 25583-20-4, Titanium nitride (TiN)
(intermetallic aluminides and silicides articles, such as **sputtering** targets, and methods of making same with **high purity** and good stoichiometry)

L59 ANSWER 2 OF 15 HCA COPYRIGHT 2002 ACS

135:39802 High-strength **sputtering** targets of **high-purity** metals and alloys and method of making using casting and homogenization. Segal, Vladimir; Ferrasse, Stephane; Willett, William B. (Honeywell Inc., USA). PCT Int. Appl. WO 2001044536 A2 20010621, 38 pp. DESIGNATED STATES: W: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM; RW: AT, BE, BF, BJ, CF, CG, CH, CI, CM, CY, DE, DK, ES, FI, FR, GA, GB, GR, IE, IT, LU, MC, ML, MR, NE, NL, PT, SE, SN, TD, TG, TR. (English). CODEN: PIXXD2. APPLICATION: WO 2000-US33997 20001215. PRIORITY: US 1999-465492 19991216.

AB Described is a high quality **sputtering** target and method of manuf. which involves application of equal channel angular extrusion as well as casting and homogenization.

IT **7440-25-7**, Tantalum, processes
(high-strength **sputtering** targets of **high-purity** metals and alloys and method of making using casting and homogenization)

RN 7440-25-7 HCA

CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

IC ICM C23C014-34

CC 76-12 (Electric Phenomena)
Section cross-reference(s): 56

ST **sputtering** target metal casting extrusion homogenization forging

IT Annealing
Casting of metals
Extrusion of metals
Forging
Homogenization
Quenching (cooling)
Sputtering targets

Texture (metallographic)
(high-strength **sputtering** targets of **high-purity** metals and alloys and method of making using casting and homogenization)

IT Alloys, processes
Metals, processes
(high-strength **sputtering** targets of **high-purity** metals and alloys and method of making using casting and homogenization)

IT Process control
(texturing; high-strength **sputtering** targets of **high-purity** metals and alloys and method of making using casting and homogenization)

IT 7429-90-5, Aluminum, processes 7439-98-7, Molybdenum, processes 7440-02-0, Nickel, processes 7440-06-4, Platinum, processes 7440-22-4, Silver, processes **7440-25-7**, Tantalum, processes 7440-32-6, Titanium, processes 7440-50-8, Copper, processes 7440-57-5, Gold, processes 11100-89-3
(high-strength **sputtering** targets of **high-purity** metals and alloys and method of making using casting and homogenization)

L59 ANSWER 3 OF 15 HCA COPYRIGHT 2002 ACS

133:62335 Apparatus for producing **high-purity** powder from vapors of solid material. Ono, Kazuyuki (Tokin Corp., Japan). Jpn. Kokai Tokkyo Koho JP 2000178613 A2 20000627, 4 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1998-376033 19981218.

AB Vapors of a solid material generated in a **sputtering** container are passed successively through a heating tank made of a material contg. .gtoreq.20 at.% of .gtoreq.1 from Mo, Ta, W, Re, and OS, a heated reverse valve, and a variable slit. Then they are passed through a pos.-pressure gas layer and a cooling tank for a rapid diffusion cooling. Contamination with impurities is effectively prevented.

IT **7440-25-7**, Tantalum, uses
(heating container from material contg.; app. for producing **high-purity** powder from vapors of solid material)

RN 7440-25-7 HCA

CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

IC ICM B22F009-12

CC 56-4 (Nonferrous Metals and Alloys)

ST solid vapor **sputtering** heating cooling powder

IT Cooling
Heating
Powders
Solids
Sputtering

Vapors
(app. for producing **high-purity** powder from vapors of solid material)

IT 7439-98-7, Molybdenum, uses 7440-04-2, Osmium, uses 7440-15-5, Rhenium, uses **7440-25-7**, Tantalum, uses 7440-33-7, Tungsten, uses
(heating container from material contg.; app. for producing **high-purity** powder from vapors of solid material)

L59 ANSWER 4 OF 15 HCA COPYRIGHT 2002 ACS
132:58046 **Highly-pure** SrxBiyTa2O5+x+3y/2 **sputtering** target materials. Suzuki, Akira; Suzuki, Tsuneo; Shindo, Yuichiro (Japan Energy K. K., Japan). Jpn. Kokai Tokkyo Koho JP 2000001774 A2 20000107, 5 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1998-169900 19980617.

AB The **sputtering** materials SrxBiyTa2O5+x+3y/2 (0.7 < x < 1.2, 2 < y < 3) contain .ltoreq.100ppm Na, K, Mg, Fe, Ni, Co, Cr, Cu and Al, as well as .ltoreq.10ppm U and Th. The materials have improved dielec. property and reduce current leaks.

IC ICM C23C014-34
ICS C01G035-00; C04B035-495; H01B003-12

CC 76-10 (Electric Phenomena)
Section cross-reference(s): 75

ST **sputtering target** bismuth strontium **tantalum** oxide; dielec property bismuth strontium tantalum oxide

IT Dielectric properties
Sputtering targets
(**highly-pure** SrxBiyTa2O5+x+3y/2 **sputtering** target materials)

IT Dielectric films
(**highly-pure** SrxBiyTa2O5+x+3y/2 **sputtering** target materials for)

IT 166877-45-8, Bismuth strontium tantalum oxide
(**highly-pure** SrxBiyTa2O5+x+3y/2 **sputtering** target materials)

L59 ANSWER 5 OF 15 HCA COPYRIGHT 2002 ACS
131:352980 Sorbent-based gas storage and delivery system for dispensing **high-purity** gas. Hultquist, Steven J.; Tom, Glenn M.; Kirlin, Peter S.; McManus, James V. (Advanced Technology Materials, Inc., USA). PCT Int. Appl. WO 9959701 A1 19991125, 58 pp. DESIGNATED STATES: W: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM; RW: AT, BE, BF, BJ, CF, CG, CH, CI, CM, CY, DE, DK, ES, FI, FR, GA, GB, GR, IE, IT, LU, MC, ML, MR, NE, NL, PT, SE, SN, TD, TG. (English). CODEN: PIXXD2. APPLICATION: WO 1999-US11420 19990521. PRIORITY: US 1998-82596 19980521.

AB A sorbent-based gas storage and dispensing system includes a storage and dispensing vessel (10) contg. a solid-phase phys. sorbent medium (17) having a sorbate gas phys. adsorbed thereon. A chemisorbent material (138) is provided in the vessel (10) to chemisorb impurities for gas phase removal thereof. Desorbed sorbate gas is discharged from the vessel (10) by a dispensing manifold (12) coupled thereto. The chemisorbent material (138) may be provided in a capsule including an impurity-permeable, but sorbate gas-impermeable membrane (136), and installed in the vessel (10) at the time of the loading of the sorbent medium (17). Semiconductor manufg. processes and products manufd. by such processes are also described.

IT **7440-25-7**, Tantalum, uses
(ion implantation; sorbent-based gas storage and delivery system for dispensing **high-purity** gas)

RN 7440-25-7 HCA

CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

IC ICM B01D053-04

CC 47-7 (Apparatus and Plant Equipment)
Section cross-reference(s): 76

IT Memory devices
(DRAM (dynamic random access); sorbent-based gas storage and delivery system for dispensing **high-purity** gas)

IT Memory devices
(EEPROM (elec. erasable programmable read-only); sorbent-based gas storage and delivery system for dispensing **high-purity** gas)

IT Memory devices
(EPROM (erasable programmable read-only); sorbent-based gas storage and delivery system for dispensing **high-purity** gas)

IT Memory devices
(PROM (programmable read only); sorbent-based gas storage and delivery system for dispensing **high-purity** gas)

IT Memory devices
(RAM (random access); sorbent-based gas storage and delivery system for dispensing **high-purity** gas)

IT Memory devices
(ROM (read only); sorbent-based gas storage and delivery system for dispensing **high-purity** gas)

IT Memory devices
(SRAM (static random access); sorbent-based gas storage and delivery system for dispensing **high-purity** gas)

IT Vapor deposition process
(chem.; sorbent-based gas storage and delivery system for

dispensing **high-purity** gas)

IT Drying apparatus
(clothes; sorbent-based gas storage and delivery system for dispensing **high-purity** gas)

IT Air conditioning
(dehumidification, app.; sorbent-based gas storage and delivery system for dispensing **high-purity** gas)

IT Electric appliances
(dishwashers; sorbent-based gas storage and delivery system for dispensing **high-purity** gas)

IT **Sputtering**
Sputtering
(etching, ion-beam, reactive; sorbent-based gas storage and delivery system for dispensing **high-purity** gas)

IT Air conditioners
(humidifiers; sorbent-based gas storage and delivery system for dispensing **high-purity** gas)

IT Etching
(plasma; sorbent-based gas storage and delivery system for dispensing **high-purity** gas)

IT Air conditioners
Capacitors
Chemisorption
Cleaning
Doping
Electric insulators
Electrodes
Epitaxy
Freezers
Ion implantation
Memory devices
Refrigerating apparatus
Resistors
Semiconductor devices
Semiconductor materials
Transistors
Vapor deposition process
(sorbent-based gas storage and delivery system for dispensing **high-purity** gas)

IT Carbanions
(sorbent-based gas storage and delivery system for dispensing **high-purity** gas)

IT Aluminosilicates, uses
Diatomite
Fluoropolymers, uses
Glass fiber fabrics
Polysiloxanes, uses
(sorbent; sorbent-based gas storage and delivery system for dispensing **high-purity** gas)

IT Etching
Etching

(**sputter**, ion-beam, reactive; sorbent-based gas storage and delivery system for dispensing **high-purity** gas)

IT Electric appliances
(washing machines; sorbent-based gas storage and delivery system for dispensing **high-purity** gas)

IT 7439-95-4, Magnesium, uses 7440-24-6, Strontium, uses 7440-39-3, Barium, uses 7440-70-2, Calcium, uses
(film sorbent; sorbent-based gas storage and delivery system for dispensing **high-purity** gas)

IT 7429-90-5, Aluminum, uses 7439-88-5, Iridium, uses 7439-98-7, Molybdenum, uses 7440-02-0, Nickel, uses 7440-03-1, Niobium, uses 7440-05-3, Palladium, uses 7440-06-4, Platinum, uses 7440-16-6, Rhodium, uses **7440-25-7**, Tantalum, uses 7440-32-6, Titanium, uses 7440-33-7, Tungsten, uses 7440-47-3, Chromium, uses 7440-50-8, Copper, uses 7440-57-5, Gold, uses 7440-62-2, Vanadium, uses
(ion implantation; sorbent-based gas storage and delivery system for dispensing **high-purity** gas)

IT 7440-09-7, Potassium, uses 7440-17-7, Rubidium, uses 7440-23-5, Sodium, uses 7440-46-2, Cesium, uses
(scavenger; sorbent-based gas storage and delivery system for dispensing **high-purity** gas)

IT 84683-45-4P, Polycide
(sorbent-based gas storage and delivery system for dispensing **high-purity** gas)

IT 78-10-4, Tetraethylorthosilicate 78-40-0, Triethylphosphate 97-94-9, Triethylborane 121-43-7, Trimethylborate 121-45-9, Trimethylphosphite 122-52-1, Triethylphosphite 150-46-9, Triethylborate 512-56-1, Trimethylphosphate 593-90-8, Trimethylborane 1590-87-0, Disilane 3275-24-9, Tetrakisdimethylamidotitanium 7637-07-2, Boron trifluoride, processes 7664-41-7, Ammonia, processes 7705-07-9, Trichlorotitanium, processes 7719-12-2, Phosphorus trichloride 7783-82-6, Tungsten hexafluoride 7784-42-1, Arsine 7803-51-2, Phosphine 7803-62-5, Silane, processes 10294-34-5, Boron trichloride 13283-31-3, Borane, processes 13465-78-6, Chlorosilane 19287-45-7, Diborane
(sorbent-based gas storage and delivery system for dispensing **high-purity** gas)

IT 144-49-0D, Fluoroacetic acid, polymers 733-90-4, Trityllithium 1344-28-1, Alumina, uses 7440-44-0, Carbon, uses 7631-86-9, Silica, uses 9002-84-0, Polytetrafluoroethylene 9003-07-0, Polypropylene 24937-79-9, Polyvinylidene fluoride 52439-05-1, Noryl 126755-96-2, Potassium arsenide
(sorbent; sorbent-based gas storage and delivery system for dispensing **high-purity** gas)

L59 ANSWER 6 OF 15 HCA COPYRIGHT 2002 ACS
127:354389 Process and apparatus for generation of large-current and **high-purity** ion beams. Oya, Toshihiko; Yano, Tetsuo; Yoneda, Michifumi; Katsumura, Munehide (Agency of Industrial

Sciences and Technology, Japan). Jpn. Kokai Tokkyo Koho JP 09283038 A2 19971031 Heisei, 5 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1996-115712 19960412.

AB The process involves the following steps: (1) supplying voltage between a target and an ion-deriving electrode, and simultaneously irradiating the target with laser beams to form plume; and (2) deriving ions from the plume by the ion-deriving electrode. The app. consists of the target, the electrode, a laser generator, and a power source. Large-current and **high-purity** ion beams can be efficiently obtained from any solid element as a target, which are useful for ion-beam implantation, vapor deposition, **sputtering**, and etching in manuf. of semiconductor devices.

IT **7440-25-7**, Tantalum, processes
(ion beams, targets, irradn. of, with laser beams; app. for generation of large-current ion beams for semiconductor device manuf.)

RN 7440-25-7 HCA

CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

IC ICM H01J027-24
ICS C23C014-28; H01J037-08; H01L021-203; H01L021-265; H01L021-3065; H01S003-00

CC 76-3 (Electric Phenomena)

IT **Sputtering**
(etching, ion-beam; app. for generation of large-current ion beams for semiconductor device manuf.)

IT Etching
(**sputter**, ion-beam; app. for generation of large-current ion beams for semiconductor device manuf.)

IT **7440-25-7**, Tantalum, processes 7440-50-8, Copper, processes
(ion beams, targets, irradn. of, with laser beams; app. for generation of large-current ion beams for semiconductor device manuf.)

L59 ANSWER 7 OF 15 HCA COPYRIGHT 2002 ACS

127:38197 Manufacture of tantalum/silicon sintered alloys with improved **high** density and **purity**. Ushijima, Yuji; Kojima, Kazuyuki (Tokai Carbon Co., Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 09111363 A2 19970428 Heisei, 5 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1995-293457 19951017.

AB Title process involves the following steps; heating powd. mixts. of 2.0-3.0 at.% Ta, 6.0-7.0 at.% Si and metal powders contg. W, Cr, Ti, Zr, Mo, Nb and/or Hf or metal silicide powders at 1100-1200.degree. under vacuum or inactive gas atm., mixing again and hot-pressing at <T (T = m.p. of Si) under inactive gas atm. The alloys are suitable for **sputtering** targets of semiconductors, thermal heads, etc.

IT **7440-25-7**, Tantalum, processes
(manuf. of Ta/Si sintered alloys with improved **high** d. and **purity** by hot pressing)
RN 7440-25-7 HCA
CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

IC ICM C22C001-04
ICS C23C014-34; C23C014-06
CC 56-5 (Nonferrous Metals and Alloys)
ST tantalum silicon sintered alloy **high purity**; hot pressing tantalum silicon sintered alloy
IT Sintering
(manuf. of Ta/Si sintered alloys with improved **high** d. and **purity** by hot pressing)
IT **7440-25-7**, Tantalum, processes 12039-79-1, Tantalum disilicide 12039-90-6, Zirconium silicide (ZrSi2) 190438-40-5 190438-41-6 190438-42-7 190438-43-8 190438-44-9
(manuf. of Ta/Si sintered alloys with improved **high** d. and **purity** by hot pressing)

L59 ANSWER 8 OF 15 HCA COPYRIGHT 2002 ACS
126:254146 **High-purity** titanium materials for **sputtering** targets. Ueda, Yasuo; Yoshimura, Yasutoku; Okamoto, Setsuo (Sumitomo Shichitsukusu Kk, Japan). Jpn. Kokai Tokkyo Koho JP 09049074 A2 19970218 Heisei, 6 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1995-201072 19950807.
AB The materials contain .ltoreq.1 ppm each of refractory **metals** (Mo, **Ta**, W, Nb, Zr) and optionally .ltoreq.0.05 ppm Al. The materials are useful in forming electrode materials on the surface of semiconductor devices by **sputtering**. The low content of refractory metals extends electron recombination time and the low content of Al stabilizes elec. resistance of the films made of the materials for the semiconductor devices.
IT **7440-25-7**, Tantalum, uses
(microalloying titanium for **sputtering** target materials for semiconductor devices)
RN 7440-25-7 HCA
CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

IC ICM C23C014-34
ICS C22C014-00; H01L021-203; H01L021-285
CC 56-3 (Nonferrous Metals and Alloys)
Section cross-reference(s): 76
ST molybdenum microalloying titanium **sputtering** target; tantalum microalloying titanium **sputtering** target;

tungsten microalloying titanium **sputtering** target; niobium microalloying titanium **sputtering** target; zirconium microalloying titanium **sputtering** target; titanium **sputtering** target semiconductor device

IT **Sputtering** targets
(microalloyed titanium for)

IT Semiconductor devices
(microalloyed titanium for **sputtering** targets for)

IT 7440-32-6, Titanium, processes
(microalloyed for **sputtering** target materials for semiconductor devices)

IT 7429-90-5, Aluminum, uses 7439-98-7, Molybdenum, uses 7440-03-1, Niobium, uses **7440-25-7**, Tantalum, uses 7440-33-7, Tungsten, uses 7440-67-7, Zirconium, uses
(microalloying titanium for **sputtering** target materials for semiconductor devices)

L59 ANSWER 9 OF 15 HCA COPYRIGHT 2002 ACS

123:131451 Multielement Characterization of **High-Purity** Titanium for Microelectronics by Neutron Activation Analysis. Wildhagen, Dieter; Krivan, Viliam (Sektion Analytik und Hoechstreinigung, Universitaet Ulm, Ulm, D-89069, Germany). Analytical Chemistry, 67(17), 2842-8 (English) 1995. CODEN: ANCHAM. ISSN: 0003-2700. Publisher: American Chemical Society.

AB A radiochem. neutron activation anal. technique for the detn. of 26 elements including the .alpha.-emitting elements Th and U and Cu, Fe, K, Na, Ni, and Zn was developed. The radiochem. sepn. was performed by anion exchange on a Dowex 1 .times. 8 column from HF and HF/NH4F medium. It leads to a selective removal of the matrix-produced radionuclides 46Sc, 47Sc, and 48Sc and a nearly selective isolation of 239Np and 233Pa, the indicator radionuclides of U and Th, resp. Counting the intensive but unspecific 511-keV .gamma.-ray of 64Cu was enabled by a selective extn. of copper with dithiazone from 15 M HF. For K, Na, Th, and U, a limit of detection of 30, 0.05, 0.03, and 0.07 ng/g, resp., was achieved. For the other elements, the detection limits were between 0.002 ng/g for Ir and 45 ng/g for Zr. The elements As, Cr, and Mn were assayed only by instrumental neutron activation anal. These techniques were applied to the anal. of two titanium **sputter** target materials of different purity grade. Results from seven elements are compared with those of isotope diln. and **glow discharge** mass spectrometry.

IT **7440-25-7**, Tantalum, analysis
(multielement detn. in **high-purity** titanium by neutron activation anal.)

RN 7440-25-7 HCA

CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

CC 79-6 (Inorganic Analytical Chemistry)

IT Radiochemical analysis
(neutron activation, multielement detn. in **high-purity** titanium by neutron activation anal.)
IT 7440-32-6, Titanium, analysis
(multielement detn. in **high-purity** titanium by neutron activation anal.)
IT 7439-88-5, Iridium, analysis 7439-89-6, Iron, analysis 7439-96-5, Manganese, analysis 7439-98-7, Molybdenum, analysis 7440-02-0, Nickel, analysis 7440-09-7, Potassium, analysis 7440-15-5, Rhenium, analysis 7440-17-7, Rubidium, analysis 7440-18-8, Ruthenium, analysis 7440-23-5, Sodium, analysis 7440-24-6, Strontium, analysis **7440-25-7**, Tantalum, analysis 7440-29-1, Thorium, analysis 7440-31-5, Tin, analysis 7440-33-7, Tungsten, analysis 7440-36-0, Antimony, analysis 7440-38-2, Arsenic, analysis 7440-39-3, Barium, analysis 7440-43-9, Cadmium, analysis 7440-46-2, Cesium, analysis 7440-47-3, Chromium, analysis 7440-48-4, Cobalt, analysis 7440-50-8, Copper, analysis 7440-55-3, Gallium, analysis 7440-58-6, Hafnium, analysis 7440-61-1, Uranium, analysis 7440-66-6, Zinc, analysis 7440-67-7, Zirconium, analysis 7440-74-6, Indium, analysis 7782-49-2, Selenium, analysis
(multielement detn. in **high-purity** titanium by neutron activation anal.)

L59 ANSWER 10 OF 15 HCA COPYRIGHT 2002 ACS
121:182836 Manufacture of **high**-density, **high-purity** graphite products by hot isostatic pressing of refractory metal-encapsulated graphite powder. Hoenig, Clarence L. (United States Dept. of Energy, USA). U.S. US 5336520 A 19940809, 4 pp. (English). CODEN: USXXAM. APPLICATION: US 1990-539270 19900618.
AB Porous graphite is hot isostatically pressed in a refractory metal container to produce solid graphite monoliths having bulk d. .gtoreq.2.10 g/mL. The refractory metal containers are formed from Ta, Nb, W, Mo, or their alloys, in the form of a canister, or the graphite may be coated with the metals by plasma spraying, vapor-phase deposition, or other suitable means. Hot isostatic pressing at 1800-2200.degree. and Ar pressure .ltoreq.30 k-psi (206.8 MPa) for 2-8 h results in a bulk d. of 2.10 g/mL. Complex shapes can be made.
IT **7440-25-7**, Tantalum, uses
(containers; hot isostatic pressing of graphite powder in, for high-d. graphite products)
RN 7440-25-7 HCA
CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

IC ICM C01B031-04
NCL 427154000
CC 49-1 (Industrial Inorganic Chemicals)

IT **Sputtering**
Vapor deposition processes
(coating by, of graphite, with refractory metal, in high-d. graphite product manuf. by hot isostatic pressing)
IT 7439-98-7, Molybdenum, uses 7440-03-1, Niobium, uses
7440-25-7, Tantalum, uses 7440-33-7, Tungsten, uses
(containers; hot isostatic pressing of graphite powder in, for high-d. graphite products)

L59 ANSWER 11 OF 15 HCA COPYRIGHT 2002 ACS
119:101823 Characterization and production of **high-purity** refractory metal **sputter** targets and refractory metal silicide **sputter** targets for application in microelectronics. Schulten, R.; Joensson, S. (Degussa AG, Hanau, D-6450, Germany). Vortr. Poster - Symp. Materialforsch. 1991, 2nd, Volume 3, 2660. Editor(s): Vierkorn-Rudolph, B.; Lillack, D.; Clar, H.-J. Forschungszentrum: Juelich, Germany. (German) 1991. CODEN: 58TWAA.
AB **High purity sputtering** targets of refractory metals and refractory metal silicides with min. contents of alkali and alk. earth metals, U, Th, Fe, Ni and Cr were produced by smelting and hot isostatic pressing of powders. Special attention is given to the prepn. of **sputtering targets** from powd. **Ta** silicide, Mo silicide, and W silicide. The **sputtering** targets are used in the manuf. of integrated elec. circuits.
CC 57-6 (Ceramics)
Section cross-reference(s): 76
ST refractory metal silicide **sputtering** target; microelectronics refractory silicide **sputtering**; tantalum silicide **sputtering** microelectronics; molybdenum silicide **sputtering** microelectronics; tungsten silicide **sputtering** microelectronics
IT **Sputtering**
(of refractory metals and refractory metal silicides, for integrated circuits)
IT Refractory metals
(**sputtering** targets of, for integrated circuits)
IT Electric circuits
(integrated, **sputtering** of refractory metals and refractory metal silicides for)
IT Refractory metal compounds
(silicides, **sputtering** targets of, for integrated circuits)
IT 7439-98-7, Molybdenum, uses 12627-41-7, Tungsten silicide
52953-72-7, **Tantalum** silicide
(**sputtering targets** of, for integrated circuits)

L59 ANSWER 12 OF 15 HCA COPYRIGHT 2002 ACS
108:172155 **High-purity** metal for **sputtering** target. Obata, Minoru; Higashinakagaha, Emiko; Kuwae, Yoshinori;

Murabayashi, Hideki (Toshiba Corp., Japan). Jpn. Kokai Tokkyo Koho JP 62294179 A2 19871221 Showa, 7 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1986-137484 19860613.

AB A **metal** (esp. Ti, **Ta**, Zr, Hf, or Cr) from halide decompn. is directly deposited on an induction-heated substrate. An electron beam or laser beam is used to irradiate the substrate surface for an accelerated deposition rate of the metal. Thus, 600 g sponge Ti and 2.5 g I were placed inside a reactor provided with a vertical Ti plate, and the reactor heated inside a furnace at 500.degree. to form TiI4 vapor. The Ti plate was induction heated to 1400.degree., and irradiated for 10 h with electron beam at 400 V and c.d. 100 mA/cm2. The resulting Ti plate contained Fe 50, Cl 90, Mn 30, C 20, H 10, and O 30 ppm as major impurities.

IT **7440-25-7P**, Tantalum, preparation
(manuf. of **high-purity**, by halide decompn. on induction-heated plate, electron beam irradn. in)

RN 7440-25-7 HCA

CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

IC ICM C23C016-48
ICS C22B034-12; C23C014-34; C23C016-14

CC 56-6 (Nonferrous Metals and Alloys)

IT 7440-32-6P, Titanium, preparation
(manuf. of **high-purity**, by decompn. of titanium iodide on induction-heated substrate, electron beam irradn. in)

IT **7440-25-7P**, Tantalum, preparation 7440-47-3P, Chromium, preparation 7440-58-6P, Hafnium, preparation 7440-67-7P, Zirconium, preparation
(manuf. of **high-purity**, by halide decompn. on induction-heated plate, electron beam irradn. in)

IT 7720-83-4, Titanium iodide (TiI4)
(thermal dissocn. of, for **high-purity** titanium coating)

L59 ANSWER 13 OF 15 HCA COPYRIGHT 2002 ACS

81:128257 Electrical resistance as a function of temperature in **pure** and doped beta-tantalum films. Kushnir, A. J.; Worobey, W. (Bell. Teleph. Lab. , Allentown , Pa., USA). Thin Solid Films, 23(2), 195-203 (English) 1974. CODEN: THSFAP.

AB The elec. resistance as a function of temp. was measured for for both pure and N-doped B-Ta films over the temp. range 2-300.degree.K. A calibrated Auger spectroscopy system was used to analyze the film samples quant. for dopant and impurity concn. The undoped film samples were prepd. under conditions expected to give a **high** degree of **purity**. These samples had resistance vs. temp. curves characterized by a broad max. occurring between 100 and 250.degree.K and a small but well-defined resistance min. at 15.degree.K. A resistance min. effect in Ta has not been

reported previously. Adding N to the films by reactive **sputtering** reduced the temp. at which the max. occurred (in films from a given system), but did not affect the temp. of the min. Detailed data on the resistance min. showed that below 10.degree.K the resistance had a logarithmic temp. dependence, indicating the possibility of magnetic scattering (the Kondo effect). Anal. of the film for potentially magnetic impurities revealed that Fe was present in an amt. between 10 and 50 ppm.

IT **7440-25-7**, properties
(elec. resistance of pure and doped films of, temp. dependence of)

RN 7440-25-7 HCA

CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

CC 71-2 (Electric Phenomena)

IT **7440-25-7**, properties
(elec. resistance of pure and doped films of, temp. dependence of)

L59 ANSWER 14 OF 15 HCA COPYRIGHT 2002 ACS

72:115674 Getter-bias **sputtering** of **high purity** metal films in a high current vacuum discharge in the 10-4 Torr range. Pinto, R.; Shaha, B. M. (Tata Inst. Fundam. Res., Bombay, India). Jap. J. Appl. Phys., 9(2), 174-81 (English) 1970. CODEN: JJAPA5.

AB It is shown that by using a Ti getter, **high**-**purity** and uniformly thick refractory metal films could be deposited at a very fast rate by a high current vacuum discharge at .apprx.10-4 torr. The system described is based on the Gaydou technique. Various discharge characteristics have been studied and the film purity has been estd. by calcg. the sp. resistivities of the films before and aft er artificial aging. The lowest resistivity of Ta film deposited with a getter and a 100 V neg. bias is 19.6 microhm-cm. Adhesivity and possible applications of Ta films in thin film hybrid technology have also been studied.

IT **7440-25-7**, uses and miscellaneous
(cathode **sputtering** of, Getter-bias)

RN 7440-25-7 HCA

CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

CC 71 (Electric Phenomena)

ST getter bias **sputtering**; **sputtering** getter bias; metal films **sputtering**; tantalum films **sputtering** deposition

IT Cathode **sputtering**
(of refractory metals, Getter-bias)

IT Getters
  (titanium, in bias **sputtering** of refractory metals)
IT **7440-25-7**, uses and miscellaneous
  (cathode **sputtering** of, Getter-bias)
IT 7440-32-6, uses and miscellaneous
  (getters, in bias **sputtering** of refractory metals)

L59 ANSWER 15 OF 15 HCA COPYRIGHT 2002 ACS
69:61229 **Sputtering highly pure** refractory
  metals in an anodically biased chamber. Theuerer, Henry C. (Bell
  Telephone Laboratories, Inc.). U.S. US 3391071 19680702, 5 pp.
  Division of U.S. 3294669 (English). CODEN: USXXAM. APPLICATION:
  US 19660804.
AB The disclosure is the same but the claims are different.
IT **7440-25-7**, uses and miscellaneous
  (coating with, by anodic **sputtering**)
RN 7440-25-7 HCA
CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

NCL 204192000
CC 56 (Nonferrous Metals and Alloys)
ST **sputtering** refractory metals; refractory metals
  sputtering
IT Superconductivity, electric
  (coating with, by anodic **sputtering**)
IT Coating process
  (with superconductors by anodic **sputtering**)
IT 7440-03-1, uses and miscellaneous **7440-25-7**, uses and
  miscellaneous 12024-15-6 12025-41-1 12039-76-8
  (coating with, by anodic **sputtering**)